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BARTONIA

Journal of the Philadelphia Botanical Club

Since its founding in 1891, the Philadelphia Botanical Club has offered outstanding programs, field trips, and other opportunities for those with an interest in plants to meet and exchange information. Monthly meetings (www.philbotclub.org/meeting.html) feature speakers from various botanical backgrounds. They are held at 7:30 p.m. on the fourth Thursday of the month in September, October, and January through May and the third Thursday in November and December, usually at the Marvin Comisky Conference Center, One Logan Square (one block east of the Academy of Natural Sciences of Drexel University). From April to October, expert field botanists lead field trips in the mid-Atlantic region and occasionally elsewhere in North America or overseas (www.philbotclub.org/field_trips.html).

Bartonia, in publication since 1909, was named for William P. C. Barton (1786-1856), Professor of Botany at the University of Pennsylvania and author of the first local flora (1818), *Compendium Florae Philadelphicae* (and nephew of physician and botanist Benjamin Smith Barton, who was a mentor of the explorer Meriwether Lewis). The journal began as an annual abstract of the Club's proceedings with short articles on the plants of the Philadelphia area. Its scope has broadened to encompass original research in plant systematics, plant ecology, and plant conservation biology with articles on floristics, distribution, methods, biography, bibliography, history of botanical exploration, and other topics of botanical interest ranging throughout—and well beyond—the mid-Atlantic region.

A subscription to *Bartonia* comes with Club membership (annual dues are $20.00 for regular members, $10.00 for full-time students) and the cost is $25.00 per issue for non-members and institutions. For addresses outside the U.S. and Canada, there is a $7.00 shipping surcharge. The membership year is from 1 January through the following 31 December. The Club is exempt from federal income tax under section 501(c)(3) of the Internal Revenue Code; contributions above the subscription cost are tax-deductible.

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Identification and Descriptions of the Gentianaceae in New Jersey

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ABSTRACT. New Jersey holds unique ecological implications for the flora of North America, containing habitats from the coastal zone to the inland highlands, and as a transition zone between the more boreal and austral zones to the north and south, respectively. Presented here are identification keys and descriptions of the genera and species of Gentianaceae (Asteridae: Gentianales) that are native to or naturalized in the state of New Jersey, USA. This information has been prepared for the Flora of New Jersey Project, a collaborative endeavor among botanists to provide modern nomenclature, identification, descriptions, distribution, abundance, and phenology data for all vascular plant species occurring naturally within the state. Keys to all genera and species are included, along with descriptions and morphological, ecological, distributional, and conservation information. These data were gathered from more than 1,650 herbarium specimens at the New York Botanical Garden (NY), the Brooklyn Botanic Garden (BKL), the Academy of Natural Sciences of Philadelphia (PH), and the Chrysler Herbarium of Rutgers University (CHRB). In total, eight genera and 19 species are treated, including the first voucher-documented record for *Schenkia spicata* (L.) G. Mans., in New Jersey.

Keywords: conservation, Gentianaceae, identification, New Jersey, rare plants

INTRODUCTION

From mountainous northern hardwood forests to lowland sandy pinelands, and from the rich Delaware River valley to the salty marshes of the Atlantic Ocean, New Jersey occupies a unique position in North America by virtue of its diverse range of habitats, despite its small size. It is home to approximately 2,800 species of vascular plants, including many threatened and vulnerable species (Kartesz 2011). New Jersey is either the northern or southern range limit of a large number of vascular plant species, making it a particularly important area in which to study speciation patterns and taxonomic migration, especially in response to climate change, non-native introductions, and habitat degradation and reclamation.

Being within easy traveling distance from both Philadelphia and New York City, the flora of New Jersey has long been studied by prominent botanists, starting with Peter (Pehr) Kalm in the early 1700s (see Fairbrothers 1964 for a review). Although a few checklists and

catalogs have been published, such as *A Preliminary Catalogue of the Flora of New Jersey* (Britton 1881), *The Plants of Southern New Jersey* (Stone 1911), and *New Jersey Wild Plants* (Hough 1983), as well as various manuals for the northeastern United States (Britton and Brown 1913, Gleason and Cronquist 1991, Haines 2011), a comprehensive manual and atlas of all vascular plant species in New Jersey has yet to be published.

The Flora of New Jersey Project (FNJP 2012) aims to provide up-to-date information on nomenclature, identification, distribution, abundance, and phenology for all naturally occurring vascular plants in New Jersey. It is a non-profit organization that was started in 2004 by regional field botanists who recognized the need for a modern statewide floristic manual. Floristic data are currently being compiled by FNJP volunteers from both field observations and collections from regional herbaria. The floristic treatments will be available via a free-access Internet site (http://www.njflora.org/), and a hard-copy manual will be published when the flora is complete.

New Jersey Physiography

New Jersey has four physiographic provinces that roughly follow the elevational gradient across the state (Figure 1).

Valley and Ridge Province—This province begins in the northwest corner of the state and occupies much of Sussex and Warren counties (Figure 2). This province is about 17 miles wide (536 square miles total) and consists of a series of steep, linear ridges and valleys with altitudes ranging from 300 ft. to 1,803 ft. above sea level (Dalton 2003). It has a northeast to southwest orientation, extending into mountainous regions in both Pennsylvania and New York (Pocono Mountains and Catskill Mountains, respectively).

Highlands Province—The Highlands province is located to the southeast of the Valley and Ridge province and occupies about 980 square miles, ranging from 10 to 25 miles wide (Dalton 2003). This province is known for rugged, rounded ridges up to 1,490 ft. above sea level and deep, narrow valley bottoms, less than 400 ft. above sea level (Dalton 2003). The Highlands province occupies areas in Bergen, Hunterdon, Morris, Passaic, Somerset, Sussex, and Warren counties.

Piedmont Province—The next province, the Piedmont, is located to the southeast of the Highlands province and occupies about 1,600 square miles, consisting of a low, rolling plain, mostly of sedimentary rock, ranging from 100 ft. to 914 ft. in altitude (Dalton 2003). This province occupies areas of Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Morris, Passaic, Somerset, and Union counties.

Coastal Plain Province—The boundary between the Piedmont and the Coastal Plain provinces is known as the Fall Line, and is marked by a series of waterfalls and rapids, as well as a change in tidal influences. The Coastal Plain province, made up of unconsolidated sand and gravel, is the largest province in New Jersey (4,667 square miles, about 3/5 of the state; Dalton 2003). It extends from sea level to a maximum altitude of 391 ft. (Dalton 2003). The Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Middlesex, Monmouth, Ocean, and Salem counties are included in the Coastal Plain province.

Gentians of New Jersey

We present information here on the 19 species (eight genera) of Gentianaceae (Asteridae: Gentianales) that occur in New Jersey. These species are classified into two different tribes, Chironieae and Gentianeae (Struwe et al. 2002; Table 1). Basionyms and commonly used

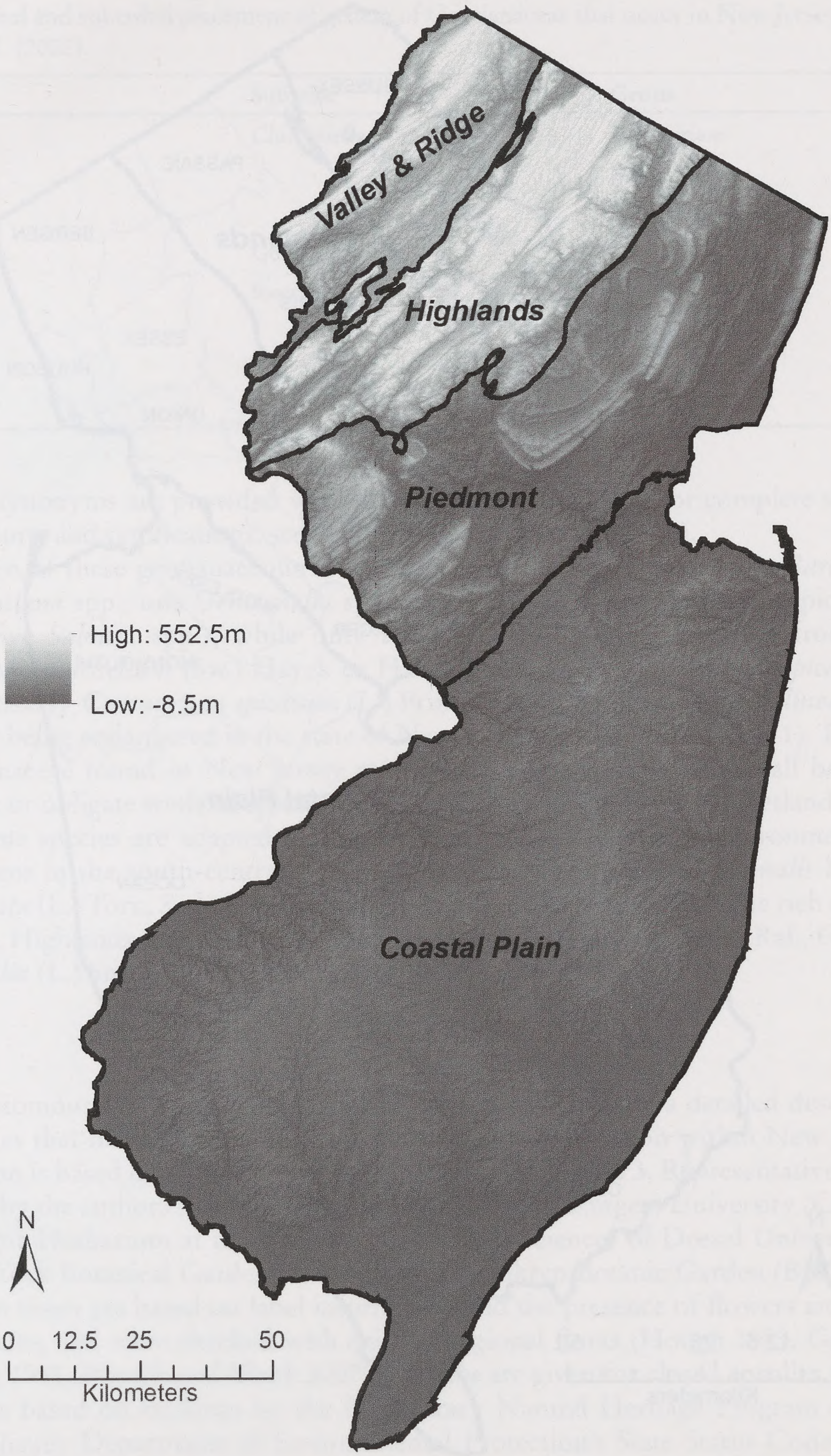

Figure 1. Physiographic provinces and elevation of New Jersey (Data sources: Physiographic provinces—New Jersey Department of Environmental Protection (NJDEP) and New Jersey Geological Society (NJGS); 10-meter resolution digital elevation model mosaic of New Jersey—U.S. Geological Survey (USGS)).

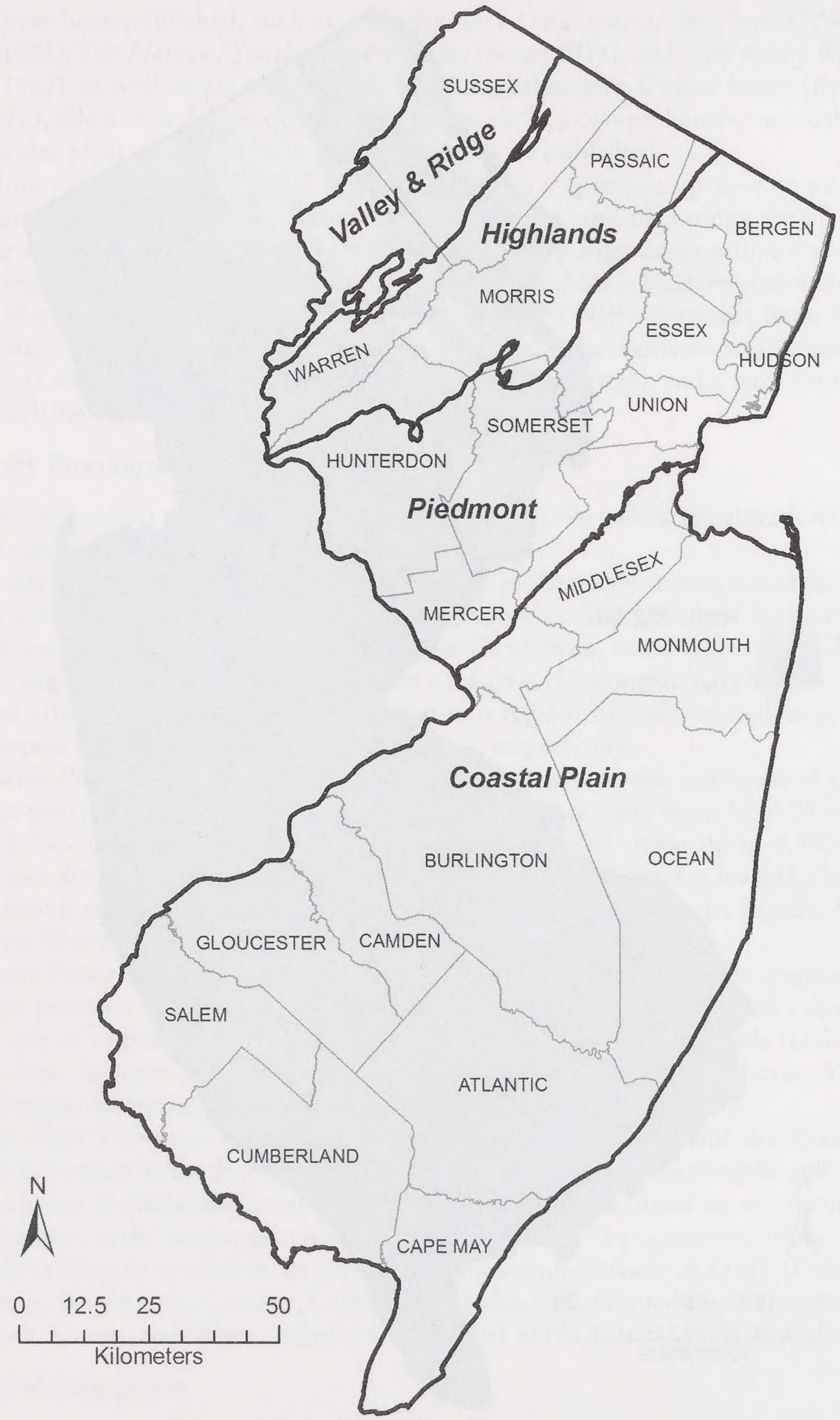

Figure 2. Physiographic provinces and counties of New Jersey (Data Sources: Physiographic provinces—New Jersey Department of Environmental Protection (NJDEP) and New Jersey Geological Society (NJGS); New Jersey counties—New Jersey Office of Information Technology (NJOIT) and Office of Geographic Information Systems (OGIS)).

Table 1. Tribal and subtribal placement of genera of Gentianaceae that occur in New Jersey, following Struwe et al. (2002).

Tribe	Subtribe	Genus
Chironieae	Chironiinae	*Centaurium*
		Sabatia
		Schenkia
Gentianeae	Gentianinae	*Gentiana*
	Swertiinae	*Bartonia*
		Gentianella
		Gentianopsis
		Obolaria

or recent synonyms are provided with the species descriptions. For complete synonymy, nomenclature, and typifications, see Pringle et al. 2015 (in this issue).

Seventeen of these gentianaceous species are native to New Jersey (two *Bartonia* spp., seven *Gentiana* spp., one *Gentianella* sp., one *Gentianopsis* sp., the monotypic *Obolaria* sp., and five *Sabatia* spp.), while only two are introduced non-natives from Eurasia (*Centaurium pulchellum* (Sw.) Hayek ex Hand.-Mazz. et al. and *Schenkia spicata* (L.) G. Mans. [formerly *Centaurium spicatum* (L.) Fritsch]. One species, *Gentiana linearis* Froel., is listed as being endangered in the state of New Jersey by the NJDEP (2011). The species of Gentianaceae found in New Jersey are typically hydrophytic plants, all being either facultative or obligate wetland species (FAC, FACW, or OBL, National Wetland Plant List 2012). Some species are adapted to the low-nutrient, acidic, sandy environments of the Pine Barrens in the south-central part of the state (ie., *Gentiana autumnalis* L., *Sabatia campanulata* (L.) Torr., *S. difformis* (L.) Druce, etc.), while others prefer the rich soils of the Piedmont, Highlands, and Valley and Ridge regions (i.e., *Gentiana clausa* Raf., *Gentianella quinquefolia* (L.) Small subsp. *quinquefolia*, etc.).

Methods

A dichotomous key to all species was developed, followed by a detailed description of each species that includes rarity, habitat, and locality information within New Jersey. All information is based on 1,652 herbarium specimens (Appendix 3, Representative Specimen List) seen by the authors from the Chrysler Herbarium of Rutgers University (CHRB), the Philadelphia Herbarium at the Academy of Natural Sciences of Drexel University (PH), the New York Botanical Garden (NY), and the Brooklyn Botanic Garden (BKL). Habitat and bloom times are based on label information and the presence of flowers and/or fruits on specimens, and were checked with existing regional floras (Hough 1983, Gleason and Cronquist 1991, Rhoads and Block 2007). Lengths are given for closed corollas.

Rarity is based on rankings by the New Jersey Natural Heritage Program (2010) and the New Jersey Department of Environmental Protection's State Status Codes (NJDEP 2011; Table 2). Regional rarity status is also reported as listed by the Highlands Water Protection and Planning Act (New Jersey Highlands Council 2004) and the Pinelands Commission (New Jersey Pinelands Commission 2007). The Highlands Water Protection and Planning Act is effective within the jurisdiction of the Highlands province (parts of

Table 2. Conservation status for rare Gentianaceae of New Jersey (New Jersey Natural Heritage Program 2010; see Appendix 1 for definitions of ranks and status).

Scientific name	Common name	Global Rank	NJ State Rank	Federal Status	NJ State Status	Regional Status
Gentiana andrewsii var. *andrewsii*	Closed bottle gentian	G5?T5?	S2	None	None	HL
Gentiana autumnalis	Pine barren gentian	G3	S3	None	None	LP, HL
Gentiana catesbaei	Catesby's gentian	G5	SX.1	None	None	HL
Gentiana linearis	Narrow-leaf gentian	G4G5	SH	None	E	LP, HL
Gentiana saponaria	Soapwort gentian	G5T5	S3	None	None	HL
Gentiana villosa	Striped gentian	G4	SX.1	None	None	HL
Gentianella quinquefolia subsp. *quinquefolia*	Agueweed	G5 T4T5	S2	None	None	HL
Obolaria virginica	Virginia pennywort	G5	S2	None	None	HL
Sabatia campanulata	Slender marsh-pink	G5	S3	None	None	HL
Sabatia dodecandra	Large marsh centaury	G5? T4T5	S2	None	None	HL

Bergen, Hunterdon, Morris, Passaic, Somerset, Sussex, and Warren counties), as shown in Figure 2. The Pinelands Commission lists 54 plant species that are threatened or endangered in the Pinelands region, which covers about 1.1 million acres across Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Ocean counties (New Jersey Pinelands Commission 2007).

The National Wetland Plant List (2012) was consulted for Wetland Indicator Status of the species included in this treatment (Table 3).

Key to the Gentianaceae Genera of New Jersey

1. Leaves scalelike, to 5 mm long and scarcely wider than stem diameter ..... *Bartonia*
1. Leaves more than 5 mm long and/or distinctly wider than stem diameter ..... 2.
    2. Corollas with projecting appendages between true lobes ..... *Gentiana*
    2. Corollas without appendages between lobes..... 3.
        3. Corollas rotate, tube much shorter than lobes; styles cleft deeper than 1 mm, style branches and stigmas often helically coiled .....*Sabatia*
        3. Corollas salverform, funnelform, campanulate, or cylindric, tube about as long as or longer than lobes; styles not cleft or cleft to 1 mm or less, neither style branches nor stigmas coiling ..... 4.
            4. Flowers subtended by 2 separate, leaf-like bracts but without a calyx (the two bracts at base of flower sometimes interpreted as a calyx).....*Obolaria*
            4. Flowers with a calyx of 4−12(−14) sepals, sepals united at least near base ..... 5.
                5. Corollas pink to rose-violet or rarely white, tube narrowly cylindric, less than 2 mm in diameter, lobes entire or minutely erose near apex; anthers coiling helically ..... 6.
                    6. Inflorescence a dichasial cyme, ± flat-topped ..... *Centaurium*
                    6. Inflorescence largely spikelike, elongated, only 1 or 2 proximal divisions dichasial .....*Schenkia*
                5. Corollas blue, violet, or rarely white, tube narrowly funnelform or if ± cylindric more than 5 mm in diameter and lobes fringed; anthers not coiling ..... 7.
                    7. Corollas 25-60 mm long, lobes 10-25 mm long, margins fringed .....*Gentianopsis*
                    7. Corollas 10-23 mm long, lobes 3.5-8 mm long, margins entire..... *Gentianella*

Descriptions of Genera and Species

Bartonia Muhl. ex Willd., Neue Schriften Ges. Naturf. Freunde Berlin 3: 444. 1801.
screwstem

Annuals, glabrous. **Leaves** cauline, opposite or alternate, scalelike. **Inflorescences** dichasial or racemoid cymes or reduced thyrses. **Flowers** 4-merous; calyx lobed nearly to base; corolla white to yellowish or greenish white, sometimes purple-tinged, narrowly campanulate, glabrous, lobes longer than tube, margins entire or erose, appendages absent; stamens inserted in corolla sinuses, anthers free; ovary sessile or subsessile; style absent; stigma bilobed; nectaries absent. **Capsules** compressed-cylindric.

Table 3. Wetland classification for gentian species in New Jersey, using the 2012 National Wetland Indicator Status (National Wetland Plant List 2012; see Appendix 2 for status definitions).

Scientific Name	Common Name	Northcentral & Northeast Region (incl. NJ)	Eastern Mountains and Piedmont Region (incl. NJ)	Atlantic and Gulf Coastal Plain Region (incl. NJ)
Bartonia paniculata	Twining screwstem	OBL	OBL	OBL
Bartonia virginica	Yellow screwstem	FACW	FACW	FACW
Centaurium pulchellum	Branched centaury	FAC	FAC	FACU
Gentiana andrewsii	Closed bottle gentian	FACW	FACW	FACW
Gentiana autumnalis	Pine barren gentian	—	FACW	FACW
Gentiana catesbaei	Catesby's gentian	—	OBL	OBL
Gentiana clausa	Bottle gentian	FACW	FACW	FAC
Gentiana linearis	Narrow-leaf gentian	FACW	OBL	OBL
Gentiana saponaria	Soapwort gentian	FACW	FACW	FACW
Gentianella quinquefolia	Agueweed	FAC	FAC	FACW
Gentianopsis crinita	Greater fringed-gentian	FACW	OBL	FACW
Obolaria virginica	Virginia pennywort	—	—	—
Sabatia angularis	Rose-pink	FAC	FAC	FACW
Sabatia campanulata	Slender marsh-pink	FACW	FACW	FACW
Sabatia difformis	Lanceleaf rose gentian	—	OBL	OBL
Sabatia dodecandra	Large marsh centaury	OBL	OBL	OBL
Sabatia stellaris	Rose-of-Plymouth	FACW	FACW	OBL
Schenkia spicata	Spiked centaury	FACW	—	FACW

1. Corolla lobe margin entire, corolla apices acute or acuminate, not mucronate; style stout, stigmas spreading ..... *B. paniculata*
1. Corolla lobe margin erose-serrate, corolla apices rounded or abruptly acute, mucronate; style slender, stigmas connivent ..... *B. virginica*

Bartonia paniculata (Michx.) Muhl., Cat. Pl. Amer. Sept. 16. 1813.
twining screwstem
Centaurella paniculata Michx., Fl. Bor.-Amer. 1: 98. 1803.
Bartonia virginica var. *paniculata* (Michx.) B. Boivin, Naturaliste Canad. 93: 1059. 1966.

Plants green, decumbent to erect or ± twining, 3-52 cm tall. **Leaves** all alternate or occasionally most leaves opposite or subopposite, 0.5-3.0 mm long. **Inflorescences** racemoid to compound cymes or thyrses with branching variable, often arcuate-ascending. **Flowers:** calyx lobes lanceolate to ovate, 1.0−3.2 × 0.3−1.1 mm, acute to acuminate; corolla white or occasionally pale yellow to green, often purple-tinged apically, 2.0-6.2 mm long, lobes oblong-lanceolate, 1.5−4.0 × 0.7−2.0 mm, margins entire, apices acute to acuminate; anthers yellow or purple, 0.3-0.9 mm long, not recurving or coiling, apices rounded to acute or mucronate; style stout, stigmas spreading. **Capsule** dehiscing from apex.

Bartonia paniculata subsp. ***paniculata***
twining screwstem
Bartonia lanceolata Small, Fl. S.E. U.S. 932. 1336. 1903.

Plants green, sometimes yellowish or purplish in the lower parts, decumbent to erect or ± twining, 10-45 cm tall. **Flowers:** calyx lobes 1.5−2.9 × 0.5−1.0 mm, all separate nearly to base; corolla 2.9-5.0 mm long; anthers yellow, 0.3-0.5 mm long, apex rounded. $2n = 52$ (Rork 1949).

Native, found infrequently throughout central and southern New Jersey, including the Pine Barrens. Obligate wetland plant (OBL, National Wetland Plant List 2012), rarely found in uplands. **Counties:** Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Middlesex, Monmouth, Ocean, Salem. **Habitat:** moist, open, sandy areas; bogs; swamps; edge of ponds and salt marshes; wet woods. **Blooms** August through October.

Bartonia virginica (L.) Britton, Sterns, & Poggenb., Prelim. Cat.: 36. 1888.
yellow screwstem
Sagina virginica L., Sp. Pl. 2: 128. 1753.

Plants green, sometimes yellowish or purplish in the lower parts, ± erect, 3-45 cm tall. **Leaves** all opposite or lower leaves (rarely all) sometimes alternate, 0.9-4.7 mm long. **Inflorescences** racemoid cymes or thyrses with strongly ascending branches. **Flowers:** calyx tube 0.1−0.3(−0.5) mm long, lobes lanceolate, 2.0−4.5 × 0.4−1.1(−1.4) mm, acuminate; corolla white to yellowish green, upper parts or occasionally more extensively often purple-tinged especially at a later age, 2.3-4.4 mm long, lobes oblong, 1.6−3.2 × 0.7−1.4 mm, margins erose-serrate distally, apex rounded to abruptly acute, mucronate; anthers yellow or purple, 0.5-1.2 mm long, often recurving in age but not coiling, mucronate to short-acuminate; style slender, stigmas connivent. **Capsule** dehiscing medially.

Native, found frequently almost throughout the entire state. Facultative wetland species (FACW, National Wetland Plant List 2012), mostly found in hydrophytic conditions, although occasionally found in uplands. **Counties:** Atlantic, Bergen, Burlington, Camden, Cape May, Cumberland, Essex, Gloucester, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Ocean, Passaic, Salem, Sussex, Union, Warren. Only two specimens found from Hudson County, both collected by William Leggett, one dating from 1864 and the other from 1867. Only one specimen from Hunterdon County was located, collected by Bayard Long in 1938. This species is most likely extirpated from these two counties. **Habitat:** moist, open, and sandy areas; bogs; swamps; edges of ponds and rivers; often with *Sphagnum* spp.; wet woods. **Blooms** July to September.

Centaurium Hill, Brit. Herb. 62. 1756.
centaury

Annuals or biennials [perennials], glabrous [stems papillose-puberulent]. **Leaves** cauline, opposite, often also basal. **Inflorescences** dichasial or partly monochasial cymes. **Flowers** 5-merous; calyx deeply lobed; corolla pink to rose-violet or occasionally white [or salmon, yellow], with a whitish "eye" in center, salverform, glabrous, lobes elliptic-oblong, entire or erose-tipped; stamens inserted in upper half of corolla tube; anthers free, coiling helically at dehiscence; ovary sessile; style distinct, shallowly cleft, deciduous; stigmas 2, ovate, elliptic, or orbiculate; nectaries absent. **Capsules** cylindric.

Centaurium pulchellum (Sw.) Hayek ex Hand.-Mazz. et al., Oesterr. Bot. Z. 56: 70. 1906.
branched centaury

Gentiana pulchella Sw., Kongl. Vetensk. Acad. Nya Handl. 4: 85. 1783.

Annuals, 2-25(−30) cm tall. **Stems** 1-5 (sometimes appearing more numerous because of near-basal branching), branching throughout or in small plants often only above middle. **Leaves:** obovate to elliptic-oblong, 5−25 × 2−6 mm, basal leaves withered or occasionally persistent at flowering time; cauline elliptic-oblong (lower) to lanceolate (upper), 5−15(−25) × 1−5(−12) mm, usually acute to acuminate, occasionally obtuse. **Inflorescences** dense to ± open, dichasial or occasionally distally monochasial cymes, usually not distinctly corymboid; pedicels 1−5(−11) mm long. **Flowers:** calyx (3−)5−9(−11) mm long; corolla (5−)10−15(−17) mm long, lobes (1−)2−5 mm long; anthers 0.7−1.1 mm long; stigmas widely ovate to elliptic or orbiculate. **Seeds** dark brown or reddish brown. $2n = 36$ (Zeltner 1970, 1987, 1991).

Centaurium pulchellum is originally native to Eurasia, being widely distributed throughout Europe (except the extreme north), Madeira, North Africa, Krym, the Caucasus, Asia Minor, and west and central Asia, extending to the Punjab (Melderis 1972). It has been known as a naturalized species in North America for about two centuries (Pringle 2007). It is found infrequently, although perhaps locally abundant, along the Outer Coastal Plain (Atlantic and Cape May counties) and near the major cities of Philadelphia (Camden County) and New York (Bergen and Hudson counties). It can be found in both hydrophytic and upland conditions (FAC, National Wetland Plant List 2012). **Counties:** Atlantic, Bergen, Camden, Cape May, Hudson, Ocean. The most recent specimen record from Bergen County

found is from 1865 (collector C.F. Austin, BKL!). Only one record from Camden County was found (collector Albrecht Jahn, 1900, PH!). However, this species is likely to have spread and established new populations. **Habitat:** open, damp, grassy areas; sandy areas near the sea or slightly inland; brackish marshes; disturbed areas. **Blooms** July through September.

Gentiana L., Sp. Pl. 1: 227. 1753.
gentian

Perennials, [biennials, or annuals], glabrous or stems and calyces puberulent. **Stems** solitary or clustered, terminating caudices [or lateral from persistent rosettes; caudices not developing in monocarpic species]. **Leaves** cauline, opposite [whorled], sometimes also basal. **Inflorescences** terminal and sometimes axillary cymes (often condensed into heads) or flowers solitary. **Flowers** 5-merous [4-8 merous]; calyx tube cylindric to narrowly campanulate; bracts paired, subtending each flower in all species found in New Jersey (except *Gentiana autumnalis*); corolla blue, violet, rose-violet, or white [red, orange, yellow], diverse in shape, glabrous within, lobes shorter [longer] than tube, entire or minutely erose-serrate, alternating with projecting [rarely truncate] appendages; stamens inserted in proximal half of corolla tube, anthers connate or free; ovary stipitate; style short or indistinct, erect, persistent; stigmas 2; nectaries as many as corolla lobes, on gynophore. **Capsules** compressed-ovoid to compressed-cylindric or short-obovoid.

1. Flowers solitary or, if 2 or 3, each terminal on a short branch, not subtended by paired bracts; corolla open; leaves linear, to 5 mm wide ..... *G. autumnalis*
1. Flowers usually clustered, solitary only on smallest stems, each subtended by a pair of bracts; corollas opening narrowly or remaining closed; leaves mostly more than 5 mm wide ..... 2.
    2. Leaves linear to narrowly lanceolate, less than 15 mm wide and more than 6 times as long as wide (appendages between corolla lobes always obliquely triangular)..... ..... *G. linearis*
    2. Leaves mostly ± ovate to elliptic or obovate, at least upper leaves wider than 15 mm and/or less than 6 times as long as wide ..... 3.
        3. Lower (and often mid-stem) leaves obovate to spatulate; corolla violet or pale green with violet suffusion; appendages between lobes obliquely triangular, entire or minutely ± erose, sometimes shallowly bifid ..... *G. villosa*
    3. Leaves lanceolate, ovate, or elliptic; corolla appendages cleft or bifid with both segments of approximately equal height, or toothed ..... 4.
        4. Corolla lobes minute projections, much exceeded by appendages..... ..... *G. andrewsii*
        4. Corolla appendages shorter than or about as long as lobes; lobes triangular or semicircular to ovate or obovate..... 5.
            5. Calyx lobes elliptic to orbicular, mostly less than 2.5 times as long as wide; corolla lobes 0.7-2.5 mm long, about as long as appendages; corollas remaining tightly closed ..... *G. clausa*
            5. Calyx lobes lanceolate to oblanceolate, more than 3 times as long as wide; corolla lobes more than 2.5 mm long and/or exceeding appendages; corollas loosely closed or opening narrowly ..... 6.
                6. Leaves usually ovate, widest near base; calyx lobes mostly longer than tube; corolla lobes 5-10 mm long, 2-4 mm longer than

appendages ..... *G. catesbaei*

6. Leaves linear to elliptic, widest near middle; calyx lobes shorter than or about as long as tube; corolla lobes 3-6 mm long, less than 2 mm longer than appendages..... *G. saponaria*

Gentiana andrewsii Griseb. in Hook., Fl. Bor. Amer. (Hooker) 2: 55. 1837.
closed bottle gentian, closed gentian, bottle gentian

Stems 1-20, 1-12 dm tall, decumbent to erect, glabrous or rarely puberulent. **Leaves** ± evenly spaced, elliptic-oblong to lanceolate or narrowly ovate, 3−16 × 1−5 cm, acuminate. **Inflorescences** heads of 1-25 flowers, often with additional flowers at 1−6(−9) nodes or on short branches. **Flowers:** calyx 9-29 mm long, lobes lanceolate to ovate or occasionally oblanceolate, 2-15 mm long, margins ciliate; corolla blue, white, or rarely rose-violet, tubular, completely closed, 28-45 mm long, lobes reduced to a mucro or ± triangular, to 2(−3) mm long, appendages oblong, shallowly and nearly symmetrically bifid, apex truncate, erose; anthers connate. **Seeds** winged.

Gentiana andrewsii var. *andrewsii*
closed bottle gentian, Andrews' bottle gentian

Dasystephana andrewsii (Griseb.) Small, Fl. S.E. U.S. 930, 1336. 1903.
Pneumonanthe andrewsii (Griseb.) W.A. Weber, Phytologia 33: 105. 1976.

Stems glabrous. **Corolla** lobes reduced to a mucro or at most minutely triangular, less than 1 mm long. $2n = 26$ (Rork 1949).

This species is ranked as being imperiled in New Jersey primarily due to habitat destruction (Table 1, New Jersey Natural Heritage Program 2010). It is protected by the Highlands Water Protection and Planning Act (New Jersey Natural Heritage Program 2010). Native and infrequent, usually found as a hydrophyte (FACW, National Wetland Plant List 2012). **Counties:** Bergen, Burlington, Camden, Hunterdon, Mercer, Middlesex, Morris, Somerset, Sussex, Union. **Habitat:** open, wet areas; swamps; wet meadows; calcareous soils. **Blooms** September to October.

Gentiana autumnalis L., Cat. Edwards' Nat. Hist. 11. 1776.
pine-barren gentian

Gentiana porphyrio J.F. Gmel., Syst. 2:462. 1791.

Stems 1(−3), 1.5-5.5 dm tall, decumbent to erect, glabrous. **Leaves** gradually more distantly spaced distally, linear to narrowly oblanceolate, 20−100 × 0.5−5 mm, obtuse (lower leaves) to acute. **Inflorescences:** flowers solitary, occasionally also terminating 1 or 2 branches. **Flowers:** calyx 17−40(−53) mm long, glabrous, lobes linear, 10−25(−36) mm long, margins not ciliate; corolla deep blue with greenish-yellow dots adaxially on lobes or occasionally rose-violet or white, funnelform, open, 30-65 mm long, lobes widely ovate, 10-20 mm long, appendages shallowly to deeply deeply divided into 2 subequal, lacerate, attenuate segments; anthers free. **Seeds** winged. $2n = 26$ (Rork 1949).

This species is considered rare globally (G3) and statewide (S3), and is the most severely threatened (in a global sense) of all Gentianaceae species in New Jersey (Table 1). Within New Jersey, which is its northern limit, it is restricted to the coastal plain Pine Barrens region in the south-central part of the state (Gleason and Cronquist

1991; Bien et al. 2009). It is listed by the Pinelands Commission as being threatened or endangered and is also protected by the Highlands Water Protection and Planning Act (New Jersey Natural Heritage Program 2010). Native, scattered throughout the Pine Barrens, usually as a hydrophyte, but occasionally in upland areas (FACW, National Wetland Plant List 2012). **Counties:** Atlantic, Burlington, Camden, Cape May, Cumberland, Ocean. **Habitat:** wet or dry sandy, open areas; moist open woods; roadsides; bogs; swamps; moist coastal plain pine barrens. **Blooms** September to October.

Gentiana catesbaei Walter, Fl. Carol. 109. 1788.
Catesby's gentian, Elliott's gentian
Gentiana elliottii Chapm., Fl. S. U.S. 356. 1860; *non G. elliottea* Raf. 1832.
Dasystephana parvifolia (Chapm.) Small, Fl. S.E. U.S. 930, 1336. 1903.

Stems 1-5, 1-7 dm tall, erect or nearly so, usually puberulent, occasionally glabrous. **Leaves** ± evenly spaced, usually ovate, occasionally elliptic, 15−75 × 4−30 mm, acute. **Inflorescences** ± dense cymes or heads of 1-10 flowers, sometimes with additional flowers at 1-several nodes or on branches. **Flowers:** calyx 17-55 mm long, glabrous, lobes lanceolate, 10-35 mm long, often ± foliaceous, margins ciliate; corolla blue or occasionally rose-violet, tubular, slightly to fully but narrowly open, 35-55 mm long, lobes deltoid-ovate, 5-10 mm long, appendages divided half or more of their length into 2 ± triangular, lacerate segments; anthers connate. **Seeds** winged. $2n$ = ca 26 (Pringle 1963).

Only one historic record of this species occurring in New Jersey exists (*Moldenke 3105* [NY] collected in Watchung, Somerset County, on September 20, 1926). This location and other potential habitats have been checked and no extant occurrences have been located (New Jersey Natural Heritage Program 2010). This species is therefore believed to be extirpated from New Jersey. It is an obligate wetland species (OBL, National Wetland Plant List 2012). **County:** Somerset. **Habitat:** moist open areas and woods. **Blooms** September to October.

Gentiana clausa Raf., Med. Fl. 1: 210. 1828.
bottle gentian

Stems 1-10, 2-8 dm tall, erect or decumbent, glabrous. **Leaves** ± evenly spaced, ovate, 30−150 × 10−45 mm, acuminate. **Inflorescences** heads of 1-20 flowers, sometimes with additional flowers at 1-3 nodes, rarely on short branches. **Flowers:** calyx 8-22 mm long, glabrous, lobes broadly obovate to orbiculate, 2−6(−10) mm long, margins ciliate; corolla blue or occasionally violet or white, tubular, completely closed, 23-40 mm long, lobes ovate-triangular to semicircular, 0.7-2.0 mm long, appendages oblong, deeply and unequally bifid, apex erose; anthers connate. **Seeds** winged. $2n$ = 26 (Rork 1949).

Gentiana clausa is native and found throughout the state, except for the Pine Barrens, as a hydrophyte or non-hydrophyte (FAC/FACW, National Wetland Plant List 2012). **Counties:** Bergen, Burlington, Essex, Gloucester, Hunterdon, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union, Warren. **Habitat:** moist, rich meadows, thickets, and woods in non-calcareous soils; edges of streams and wet areas. **Blooms** August to October.

Gentiana linearis Froel., Gent. 37. 1796.
narrowleaf gentian

Gentiana saponaria L. var. *linearis* (Froel.) Griseb. in Hook., Fl.-Bor. Amer. 2: 55. 1837.

Dasystephana linearis (Froel.) Britton in Britton & Brown, Ill. Fl. N. U.S., ed. 2, 3: 13. 1913.

Stems 1-30, 1-9 dm tall, erect, glabrous. **Leaves** evenly spaced or somewhat more widely spaced distally, linear to lanceolate, 40−90 × 3−14 mm, acute. **Inflorescences** ± dense cymes of 1-7 flowers, sometimes with additional flowers at 1-several nodes or on short branches. **Flowers:** calyx 8-28 mm long, glabrous, lobes linear to oblong, 2−12(−15) mm long, margins not ciliate; corolla blue or occasionally violet or white, tubular, loosely closed or slightly open, 25-50 mm long, lobes semicircular, 2.5-5.0 mm long, appendages between corolla lobes obliquely triangular, entire or shallowly erose, with a minute second segment; anthers connate. **Seeds** winged. $2n = 26$ (Rork 1949; Pringle 1969).

Very few historic records of *Gentiana linearis* in New Jersey exist (see Appendix 3). No extant occurrences are known. Although some potential locations and habitats have been explored, not all historic occurrences have been surveyed and potential habitats still exist, according to the New Jersey Natural Heritage Program (2010). Diligent searching may provide location of this species in New Jersey, making this a top conservation priority in the state (New Jersey Natural Heritage Program 2010). *Gentiana linearis* is the only species in the Gentianaceae in New Jersey that has a state status of Endangered, meaning that its survival within the state is in immediate danger (NJDEP 2011). It is also listed by the Pinelands Commission as being threatened or endangered, and is protected by the Highlands Water Protection and Planning Act (New Jersey Natural Heritage Program 2010). Usually found as a hydrophyte (FACW/OBL, National Wetland Plant List 2012). **Counties:** Burlington, Passaic. **Habitat:** moist, open areas; bogs, swamps, and meadows. **Blooms** July to September.

Gentiana saponaria L., Sp. Pl. 1: 228. 1753.
soapwort gentian

Gentiana cherokeensis (W.P. Lemmon) Fernald, Rhodora 41: 487. 1939.

Dasystephana latifolia (Chapm.) Small, Fl. S.E. US, ed. 1, 930, 1336. 1903.

Stems 1-5, 0.7-6.5 dm tall, decumbent to erect, glabrous or occasionally puberulent. **Leaves** ± evenly spaced, linear to widely elliptic, 15−120 cm × 3−30 mm, obtuse to acute. **Inflorescences** ± dense cymes or heads of 1-8 flowers, sometimes with additional cymules on short branches. **Flowers:** calyx 9-32 mm long, glabrous or occasionally puberulent, lobes narrowly oblanceolate, 4-17 mm long, margins ciliate; corolla blue or rarely rose-violet, tubular, loosely closed to slightly or occasionally (in southernmost part of range) almost fully but narrowly open, 30-50 mm long, lobes ovate-triangular, 3-7 mm long, appendages divided half or more of their length into 2 ± triangular, lacerate segments; anthers connate. **Seeds** winged. $2n = 26$ (Rork 1949).

Gentiana saponaria is listed as rare in New Jersey, with the potential of becoming imperiled (S3, New Jersey Natural Heritage Program 2010). It is protected by the Highlands Water Protection and Planning Act (New Jersey Natural Heritage Program

2010), and is a facultative wetland species, mostly occurring as a hydrophyte, but occasionally found in uplands (FACW, National Wetland Plant List 2012). It is found infrequently throughout much of New Jersey outside of the Pine Barrens. **Counties:** Atlantic, Bergen, Burlington, Camden, Cape May, Cumberland, Essex, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Salem, Somerset, Union. **Habitat:** moist open areas; open wet woods; swamps; swales; bogs. **Blooms** September to November.

Gentiana villosa L., Sp. Pl. 1: 228. 1753.
striped gentian
Gentiana deloachii (W.P. Lemmon) Shinners, Sida 1: 107. 1962.

Stems 1-5, 0.7-6 dm tall, erect, glabrous. **Leaves** ± evenly spaced, obovate to elliptic, 25−100 ×10−40 mm, proximal leaves retuse or truncate to obtuse, distal leaves ± acute. **Inflorescences** ± dense cymes of 1-10 flowers, often with additional flowers at 1-several nodes or on branches. **Flowers:** calyx 11-50 mm long, glabrous, lobes linear to oblanceolate, 5-35 mm long, margins not ciliate; corolla largely white or greenish white with veins outlined in green, sometimes suffused with violet, or grayish violet ± throughout, tubular, narrowly open, 30-55 mm long, lobes ovate-triangular, 4-10 mm long, appendages obliquely triangular, erose, occasionally shallowly bifid; anthers connate or free. **Seeds** not winged. $2n = 26$ (Rork 1949).

This species is believed to be extirpated from New Jersey. There is only one historic report of it being in found in New Jersey (*N. L. Britton s.n.* [CHRB] collected in Bridgeton, Cumberland County, September 23, 1881). This location, and other potential habitat, has been searched with no other positive identifications (New Jersey Natural Heritage Program 2010). Although extirpated species are not current conservation priorities, this species is still protected by the Highlands Water Protection and Planning Act (New Jersey Natural Heritage Program 2010). **County:** Cumberland. **Habitat:** dry open woods and serpentine barrens. **Blooms** September to October.

Gentianella Moench, Meth.: 482. 1794, nom. cons.
dwarf gentian

Annuals or **biennials** [perennials], glabrous. **Leaves** cauline, opposite [whorled], sometimes also basal. **Inflorescences:** flowers in cymes [solitary]. **Flowers** 4- or 5-merous; calyx tube cylindric to narrowly campanulate [or sometimes very short, rarely cleft and spathiform]; corolla blue-violet or rarely rose-violet, pink, white, or pale yellow [red, orange, bright yellow, green], funnelform [tubular, campanulate, or nearly salverform], glabrous [or adaxially with a fringe of trichomes or paired, deeply fringed scales near base of each lobe or small trichomes near insertion of stamens], lobes shorter than tube [or about as long as or longer than tube], entire or nearly so, no appendages between lobes; stamens inserted near or below [above] middle of corolla tube, anthers free; ovary sessile or short-stipitate; style short or indistinct, erect, persistent; stigmas 2; nectaries on inside of corolla tube near base, 1 [rarely 2] per petal. **Capsules** compressed-cylindric to compressed-ovoid.

Gentianella quinquefolia (L.) Small, Fl. S.E. U.S., ed. 1: 929. 1903.
agueweed

Gentiana quinquefolia L., Sp. Pl. 1: 230. 1753.
Gentiana amarelloides Michx., Fl. Bor.-Amer. 1: 175. 1803.

Annuals or biennials, 2-80 cm tall. **Stems** erect, usually branched distally but without long branches near base. **Leaves:** basal usually withered by flowering time, spatulate to oblanceolate, 5−35 × 2−12 mm; cauline ovate, 5−60(−80) × 2−35(−45) mm. **Inflorescences** terminal and often axillary, dichasial or partly umbelloid cymes; pedicels 1-17 mm long. **Flowers** 5-merous; calyx 2-15 mm, lobes usually subequal, subulate to lanceolate, 1−8(−10) mm long; corolla narrowly funnelform, opening narrowly, violet, violet-blue, blue, or occasionally pale yellow or white, 10-25 mm long, lobes incurved, ovate-triangular, 3.5-8.0 mm long, bristle-tipped, no scales or fringes.

Gentianella quinquefolia subsp. *quinquefolia*
agueweed, stiff dwarf-gentian"

Larger **plants** usually with extensive primary and secondary branching. **Flowers:** calyx 2−6(−8) mm long, lobes subulate to linear-oblong, 1−4(−6) mm long; corolla 10-23 mm long, lobes 3-7 mm long. $2n = 36$ (Rork 1949).

This species is native and found infrequently scattered throughout northwestern New Jersey. It imperiled in New Jersey (S2, New Jersey Natural Heritage Program 2010) and is protected by the Highlands Water Protection and Planning Act (New Jersey Natural Heritage Program 2010). Its range in New Jersey is becoming more restricted (Hough 1983). **Counties:** Morris, Passaic, Sussex, Warren. **Habitat:** wet or mesic rich meadows and forest edges; roadsides, open woods. **Blooms** September to October.

Gentianopsis Ma, Acta Phytotax. Sin. 1: 7. 1951.
fringed gentian

Annuals, biennials, or perennials, glabrous or with peduncles and calyces papillate-scabridulous. **Leaves** basal (sometimes withering before flowering time) and cauline, opposite. **Inflorescences:** flowers solitary, terminating main stem and each of any branches. **Flowers** 4-merous; calyx with 2 outer lobes usually ± longer and narrower than inner lobes, tube usually about as long as inner lobes; corolla blue to blue-violet, or occasionally rose-violet or white, rarely pale yellow, tube widely tubular or tubular-campanulate, adaxially glabrous or with minute trichomes near insertion of stamens, lobes about as long as or shorter than corolla tube, spreading, often tardily reflexed, margins usually distinctly toothed and/or fringed, rarely subentire, no appendages between lobes; stamens inserted in proximal half of corolla tube, anthers free; ovary subsessile or stipitate; style short, indistinct or rarely slender and distinct, erect, persistent; stigmas 2; nectaries on inside of corolla tube near base, 1 per petal. **Capsules** compressed-ovoid.

Gentianopsis crinita (Froel.) Ma, Acta Phytotax. Sin. 1: 15. 1951.
greater fringed gentian

Gentiana crinita Froel., Gentiana 112. 1796.
Gentianella crinita (Froel.) Bercht. & J. Presl., Prir. Rostlin 1 (Gentian.): 21. 1823.
Anthopogon crinitum (Froel.) Raf., Fl. Tellur. 3: 25. 1837 ("1836").

Annuals or biennials, (0.3−)1−6(−10) dm tall. **Stems** (except those of smallest plants) with branches or peduncles arising from nodes distinctly above base, rarely

from base. **Leaves** basal often withered by flowering time, spatulate to oblanceolate, 8−40 × 1−11 mm, apices rounded to acute; cauline (narrowly to) widely lanceolate to widely ovate, 10−80 × (4−)7−25 mm, apices acute. **Peduncles** 1−15(−20) cm long. **Flowers:** calyx 14−40(−50) mm long, outer lobes lanceolate, inner lobes ovate-oblong, apices short-acuminate; corolla deep blue or rarely rose-violet or white, 25−60(−75) mm long, lobes elliptic-obovate, 10−25 × 5−15 mm, margins with fringes to 6 mm long laterally and around apex; ovary distinctly stipitate. **Seeds** papillate, not winged. $2n = 78$ (Rork 1949).

This species is not listed with any rarity status in New Jersey. It is native and found frequently throughout much of New Jersey, although usually not in sandy areas such as the Pine Barrens. It is usually found as a hydrophyte, but sometimes in drier situations (FACW/OBL, National Wetland Plant List 2012). **Counties:** Bergen, Camden, Cape May, Essex, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union, Warren. **Habitat:** moist, rich, open meadows in calcareous soils; roadsides; boggy swales; marshes. **Blooms** September to October.

Obolaria L., Sp. Pl. 2: 632. 1753.
obolaria

Perennials, glabrous. **Leaves** cauline, opposite. **Inflorescences:** flowers terminal and axillary, solitary or in cymules of 3. **Flowers** 4-merous; calyx absent; corolla white to pale violet, narrowly campanulate, glabrous, lobes slightly longer than tube, ascending, entire or erose, 2 minute scales per petal on proximal part of tube, no appendages between lobes; stamens inserted in corolla sinuses, anthers free; ovary sessile; style short, erect, persistent; stigmas 2; nectaries in a ring at base of ovary. **Capsules** compressed-ovoid, rupturing irregularly.

Obolaria virginica L., Sp. Pl. 2: 632. 1753.
Virginia pennywort

Plants 4−17(−25) cm tall. **Stems** 1-3. **Leaves** in inflorescence fan-shaped to spatulate-obovate or orbiculate, 4−16 × 3−11 mm; all or most leaves below inflorescence minute, scalelike. **Flowers:** corolla 6-15 mm long, lobes obovate-oblong, apex acuminate. $2n = 56$ (Kondo 1970).

Obolaria virginica is imperiled in New Jersey due its rarity, with fewer than 20 occurences known, and is protected by the Highlands Water Protection and Planning Act (S2, New Jersey Natural Heritage Program 2010). New Jersey is the northern limit of this species, with it occurring mostly in the northwest highlands and on the Inner Coastal Plain in the southern part of the state. **Counties:** Camden, Cumberland, Essex, Gloucester, Hunterdon, Mercer, Morris, Salem, Somerset, Sussex, Union. **Habitat:** wet or dry woods with rich, loamy soil; shaded edges. **Blooms** April to June.

Sabatia Adans., Fam. Pl. 2:503. 1763.
rose-gentian, marsh-pink

Perennials, biennials, or annuals; perennials sometimes stoloniferous, individual crowns then sometimes biennial; glabrous. **Leaves** cauline, opposite, often also basal. **Inflorescences** cymes [or heads] or flowers solitary, cymes dichasial in species with opposite branching, monochasial in species with alternate branching. **Flowers** (4−)5−12(−14)-merous; calyx tube hemispheric to turbinate, lobes longer or shorter than tube; corolla pink or white, often

with a distinct "eye," rotate, glabrous, lobes much longer than tube, entire, appendages absent; stamens inserted in or near corolla sinuses; anthers free, straight, recurved or recoiling circinately or curving helically; ovary sessile; style distinct, deciduous, deeply cleft, initially deflexed to one side or less often erect; stigmas 2; nectaries 5 at base of ovary, not clearly differentiated. **Capsules** cylindric to ovoid or globose.

1. Flower parts in 7-12(−14)'s.....*S. dodecandra*
1. Flower parts in (4−)5(−6)'s ..... 2.
    2. Pedicels (above bracteoles) 1-8 mm long .....*S. difformis*
    2. Pedicels 10-150 mm long ..... 3.
        3. Stems 4-winged, wings distally 0.2-0.3 mm high .....*S. angularis*
        3. Stems terete or nearly so, wings absent or less than 0.2 mm high ..... 4.
            4. Cespitose perennials; leaves widest at or below middle, rounded at base; calyx more than 0.8 times as long as corolla; corolla lobes oblanceolate .....*S. campanulata*
            4. Single-stemmed annuals or biennials; leaves widest distally to middle, cuneate at base; calyx less than 0.8 times as long as corolla; corolla lobes obovate.....*S. stellaris*

Sabatia angularis (L.) Pursh, Fl. Amer. Sept. 1: 137. 1813.
rosepink, square-stemmed centaury, common rose-gentian, common marsh-pink

Chironia angularis L., Sp. Pl. 1: 190. 1753.

Biennials. Stems 4-angled and winged, (0.5−)3−7.5(−9) dm tall, lower branches mostly opposite, upper mostly alternate. **Leaves** cauline and often also basal; basal oblong-spatulate to ovate-orbiculate, cauline lanceolate to widely ovate, 10−40 × 5−30(−40) mm. **Inflorescences** open cymes; pedicels 1-6 cm long. **Flowers** 5(−6)-merous; calyx tube shallowly campanulate, low-ridged along mid- and commissural veins, 1-2 mm long, lobes linear to narrowly oblong-lanceolate or occasionally ± foliaceous, 4−15(−18) mm long; corolla pink [white], basal spots triangular, greenish yellow, usually with dark red border, tube 4-7 mm long, lobes ± narrowly spatulate-obovate, 6−22 × 2−9(−11) mm, apices rounded to subacute; anthers coiling circinately. $2n = 38$ (Perry 1971).

This species is found infrequently throughout much of New Jersey. It is found in both wet and dry conditions (FAC/FACW, National Wetland Plant List 2012). **Counties:** Atlantic, Bergen, Burlington, Camden, Cape May, Cumberland, Essex, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Somerset, Union, Warren. **Habitat:** moist, open meadows and woods; edges of fresh and salt marshes. **Blooms** July to September.

Sabatia campanulata (L.) Torre., Fl. N. Middle- United States. 1: 217. 1824.
slender rose-gentian, slender sea-pink, slender marsh-pink

Chironia campanulata L., Sp. Pl. 1: 190. 1753.
Sabbatia gracilis (Michx.) Salisb., Parad. Lond. t. 32. 1806.
S. campanulata var. *gracilis* (Michx.) Fernald, Rhodora 39: 444. 1937.

Perennials. Stems terete or 4-ridged distally, 1.5−6(−9) dm long, branching all or mostly alternate. **Leaves** cauline, narrowly lanceolate or oblong (lower) to linear (all or upper), 10−40 × 1−7(−12) mm. **Inflorescences** few-flowered cymes or flowers solitary at ends of branches; pedicels (2−)4−7(−9) cm long. **Flowers** 5-merous; calyx

tube turbinate to shallowly campanulate, not ridged or with low ridges along mid- and commissural veins, 1-3 mm long, lobes setaceous to narrowly linear, 7-15 mm long; corolla pink or rarely white, basal spots oblong, yellow, usually with red border, tube 2-6 mm long, lobes oblanceolate, 6−24 × 3−9(−11) mm, apices obtuse; anthers coiling circinately. $2n = 34$ (Perry 1971).

Sabatia campanulata is native and rare in the state of New Jersey, with the potential of becoming imperiled if current trends continue, and is protected by the Highlands Water Protection and Planning Act (S3, New Jersey Natural Heritage Program 2010). It is found infrequently in the Outer Coastal Plain, including the Pine Barrens, usually as a hydrophyte (FACW, National Wetland Plant List 2012). **Counties:** Atlantic, Burlington, Cape May, Cumberland, Monmouth, Ocean, Salem. **Habitat:** sandy, peaty bogs; wet meadows; edges of fresh and salt marshes. **Blooms** July to August.

Sabatia difformis (L.) Druce, Rep. Bot. Soc. Exch. Club Brit. Isles 3: 423. 1914.
lanceleaf rose-gentian, lance-leaved centaury

Swertia difformis L., Sp. Pl. 1: 226. 1753.
Sabbatia corymbosa Baldw. ex Ell., Sketch Bot. S. Carolina 1: 283. 1817.
Sabbatia lanceolata (Walter) Raf., Fl. Tellur. 3: 30. 1837 ("1836").

Perennials. Stems 4-angled, 2.5−10.5 dm tall, branching opposite throughout. **Leaves** cauline, linear-lanceolate to narrowly or occasionally widely elliptic-ovate, 10−40(−60) × 3−14(−22) mm. **Inflorescences** corymboid dichasia of compact cymules; pedicels 1−8(−15) mm long. **Flowers** 5(−6)-merous; calyx tube shallowly campanulate, slightly keeled dorsally, 1−2(−3) mm long, lobes lance-subulate, (2−)4−9(−14) mm long; corolla white (when dry, sometimes cream to yellow), tube 2.5-6.0 mm long, lobes oblanceolate, (5−)7−21 × 2.5−8.0 mm, apices rounded; anthers recurving. $2n = 36$ (Perry 1971).

This species is native to New Jersey and is found frequently throughout the Pine Barrens in wet conditions (OBL, National Wetland Plant List 2012). New Jersey is the northern limit of this Coastal Plain species. **Counties:** Atlantic, Burlington, Camden, Cape May, Cumberland, Ocean. **Habitat:** wet, open meadows; bogs; open woods; old cranberry bogs; acidic Pine Barren woods. **Blooms** July to August.

Sabatia dodecandra (L.) Britton, Sterns & Poggenb., Prelim. Cat. 36. 1888.
marsh rose-gentian, sea-pink, large marsh-centaury

Chironia dodecandra L., Sp. Pl. 190. 1753.
Chironia chloroides Michx., Fl. Bor.-Amer. 1: 147. 1803.
Sabbatia chloroides (Michx.) Pursh, Fl. Amer. Sept. 1: 138. 1813 ("1814").

Perennials. Stems terete or 4-ridged in the upper regions, 0.8-6 dm tall, branching all or mostly alternate. **Leaves** cauline, elliptic- or oblong-lanceolate, 15−70 × 4−12(−16) mm. **Inflorescences** open, few-flowered monochasia or flowers solitary at ends of branches; pedicels 1−9(−11) cm long. **Flowers** 7−12(−14)-merous; calyx tube turbinate to campanulate, not ridged, 1.5-4.0 mm long, lobes linear to oblong-lanceolate or occasionally narrowly spatulate or ± foliaceous, 4-20 mm long; corolla purplish pink or rarely white, basal spots oblong, sometimes shallowly 3-lobed, yellow, usually with red border, tube (3−)4−8 mm, lobes oblanceolate to narrowly spatulate-obovate, (10−)12−25 × 3−11 mm, apices rounded to subacute; anthers coiling circinately. $2n = 34 + 8b$ (Perry 1971).

Sabatia dodecandra is listed as imperiled in New Jersey because of rarity and is

protected by the Highlands Water Protection and Planning Act (S2, New Jersey Natural Heritage Program 2010). It is an obligate wetland species (OBL, National Wetland Plant List 2012) found rarely along the coast of New Jersey. **Counties:** Atlantic, Bergen, Burlington, Cape May, Hudson, Middlesex, Ocean. **Habitat:** salt marshes; wet, open areas. **Blooms** July to September.

Sabatia stellaris Pursh, Fl. Amer. Sept. 1: 137. 1813 ("1814").
rose-of-Plymouth, salt-marsh pink, annual rose-gentian

Chironia amoena Raf., Med. Repos. II. 5: 359. 1808, non Salisb., 1796.
Chironia stellaris (Pursh) Eaton, Man., ed. 2, 204. 1818.
Sabbatia amoena (Raf.) G. Don, Gen. Hist. 4: 207. 1838.
Sabbatia maculata (Benth.) A. Gray, Proc. Amer. Acad. Arts 22: 438. 1887.
Sabbatia maritima Raf., Med. Fl. 2: 77. 1830.
Sabatia simulata Britton, Bull. N.Y. Bot. Gard. 3: 448. 1905.

Annuals or biennials. Stems terete or distally 4-angled, 0.2−5(−8) dm tall, branching alternate. **Leaves** cauline, linear to elliptic or obovate, 5−60(−90) × (1−)2−10(−15) mm. **Inflorescences** open, few-flowered cymes or flowers solitary; pedicels (1−)4−10(−15) cm long. **Flowers** (4−)5-merous; calyx tube turbinate, not ridged or obscurely ridged along midveins, 1.5-6.0 mm long, lobes setaceous to linear, (4−)6−11(−22) mm long; corolla pink or rarely white, basal spots 3-lobed, yellow, usually with red border, tube 3-8 mm long, lobes oblanceolate or narrowly to medium-widely spatulate-obovate or elliptic, 5−20 × 2−10 mm, apices rounded to obtuse; anthers coiling circinately. $2n = 36 + 0-4b$ (Perry 1971).

This species is found frequently along the Outer Coastal Plain and Delaware Bay shore of New Jersey, usually in wet conditions (FACW/OBL, National Wetland Plant List 2012). **Counties:** Atlantic, Bergen, Burlington, Camden, Cape May, Cumberland, Hudson, Middlesex, Monmouth, Ocean, Salem. **Habitat:** salt marshes and meadows; open, sandy areas; swamps; brackish tidal marshes. **Blooms** July to September.

Schenkia Griseb., Bonplandia 1: 226. 1853.

Annuals or biennials, glabrous. **Leaves** basal and cauline, opposite. **Inflorescences** spikelike [racemoid], monochasial cymes, sometimes dichasial at base. **Flowers** parts in 5's; calyx deeply lobed; corolla pink to rose-violet, salverform, glabrous, lobes elliptic-oblong, shorter than [about as long as] tube, entire or erose-tipped, appendages absent; stamens inserted in or near corolla sinuses, diverging radially; anthers free, coiling helically at dehiscence; ovary sessile; style distinct, erect, deciduous; stigma 2 or 1, bilobed; nectaries absent. **Capsules** ellipsoid.

Schenkia spicata (L.) G. Mans., Taxon 53: 726. 2004.
spiked centaury

Gentiana spicata L., Sp. Pl. 230. 1753.
Centaurium spicatum (L.) Fritsch, Mitt. Naturwiss. Vereins Univ. Wien 5: 97. 1907.

Plants 4-55 cm tall. **Stems** 1-several, branching throughout. **Leaves** basal often withered or absent by flowering time, widely ovate to elliptic, 6−30 × 2−17 mm, obtuse to acute; cauline elliptic (lower) to lanceolate (upper), (6−)10−30(−45) mm × 3−8(−12) mm, acute. **Inflorescences** spikelike, a central flower at the proximal 1 or 2 divisions, otherwise all or most flowers sessile or subsessile. **Flowers** calyx (4−)7−11 mm long; corolla 10-15

mm long, lobes 3.5-5.5 mm long; anthers 1.0-1.5 mm long; stigmas 2, widely fan-shaped. **Seeds** dark reddish brown to black. $2n = 22$ (Zeltner 1970, 1991).

Originally from western Europe, eastern Asia, and northern Africa, this species is introduced in North America and has so far been found in Delaware, Maryland, Massachusetts, New Jersey, and Virginia (Mansion 2004, USDA Plants Database 2013). There have been undocumented reports of this species in New Jersey (Hough supplement 1989, Anderson 2009), and it was found in one location in New Jersey, along Arthur Kill in Elizabeth, Union County in 2009. The first vouchered specimen of this species was recollected from this same locality in September 2012 (Linda Kelly *s.n.*, August 29, 2012). This is a new documented record for the state and is not yet listed in USDA-Plants Database (2013) (Figure 3).

This species was recently removed from the genus *Centaurium* Hill and placed in the genus *Schenkia* Griseb. based on molecular studies by Mansion and Struwe (2004).

County: Union. **Habitat:** damp, sandy and grassy places near the ocean; disturbed areas; saline marshes. **Blooms** July to September.

DISCUSSION

The nineteen gentianaceous species of New Jersey presented here make up an important group of mostly native wildflowers that occur in a wide range of habitats. With many instances of rarity in New Jersey, along with the introductions of two non-native species, this group should be monitored closely for population stability and potential extirpation and migration.

Two species (*Gentiana catesbaei* and *G. villosa*) are believed to be extirpated from New Jersey, each with only one record of each from the state (from 1926 and 1881, respectively). Although there are very few historic records of *Gentiana linearis* in New Jersey (the most recent from 1941), this species is not yet believed to be extirpated, and there is still hope that the species may be located with diligent searching (New Jersey Natural Heritage Program 2010). Therefore, it is the only species in the Gentianacaeae family to have a state listing of Endangered (Table 2).

Some of the other native Gentianaceae also exhibit restricted ranges and narrow-niche requirements in New Jersey. *Gentiana autumnalis* is strongly limited to the Pine Barrens region of the Coastal Plain province, with occurrence in only six counties. *Sabatia campanulata*, *S. difformis*, and *S. dodecandra* also show strong adaptations to the conditions of the Pine Barrens, occurring in seven, six, and seven counties, respectively. Further research could be conducted to determine if the traits of these niche-specific species are plesiomorphic ancestral-niche constraints or more recent adaptations. *Sabatia difformis* is found relatively frequently in these areas, but the other species (*G. autumnalis*, *S. campanulata*, and *S. dodecandra*) should be monitored for population health and stability because of their low occurrences, and their habitats should continue to be protected from development and destruction.

Some Gentianaceae appear to be widespread throughout the state of New Jersey, such as *Bartonia virginica* (19 counties), *Gentiana saponaria* (18 counties), *Sabatia angularis* (17 counties), and *Gentianopsis crinita* (15 counties). These generalist species are found in a variety of habitats across New Jersey's diverse ecological settings.

Many Gentianaceae species in New Jersey seem to be in decline. *Gentianella quinquefolia* subsp. *quinquefolia* was reported to occur in eight counties in *New Jersey Wild Plants* (Hough 1983), but records could now be located from only four counties. It is suspected

Figure 3. Herbarium specimen of *Schenkia spicata*, first New Jersey collection (*L. Kelly s.n.*, 29 Aug. 2012 [CHRB]).

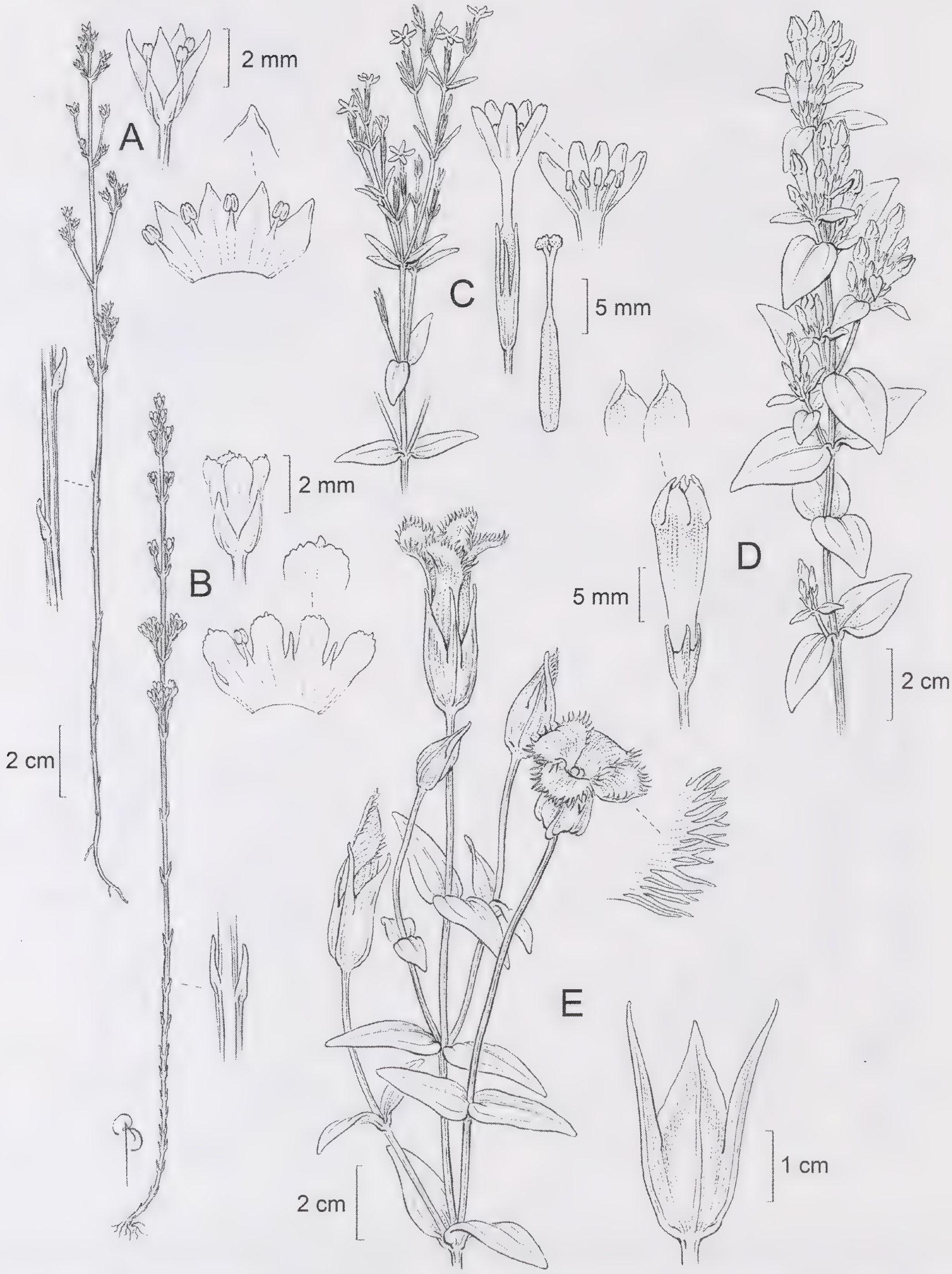

Figure 4. **A.** *Bartonia paniculata* subsp. *paniculata*: *B. Long 57253* (CHRB, dup. in PH). **B.** *Bartonia virginica*: *M.A. Chrysler s.n.*, 30 Jul. 1942 (CHRB). **C.** *Centaurium pulchellum*: *B. Long 9162* (CHRB, dup. in PH). **D.** *Gentianella quinquefolia* subsp. *quinquefolia*: *C.S. Williamson s.n.*, 29 Sept. 1906 (PH). **E.** *Gentianopsis crinita*: *S.S. Van Pelt s.n.*, 19 Sept. 1902 (PH).

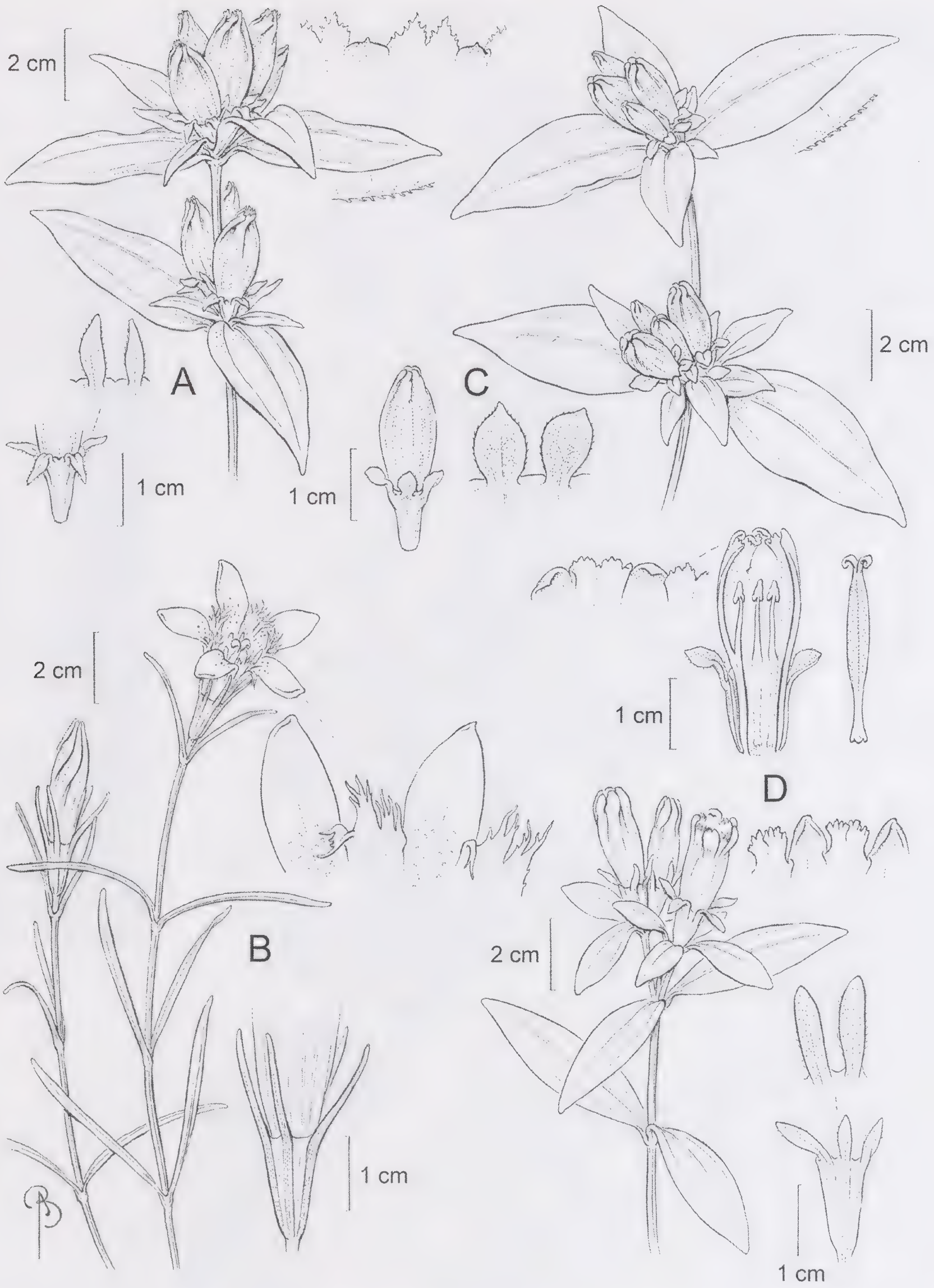

Figure 5. **A.** *Gentiana andrewsii* var. *andrewsii*: *E.A. Laport s.n.*, 8 October 1969 (CHRB). **B.** *Gentiana autumnalis*: *B. Long 55175* (PH). **C.** *Gentiana clausa*: *D.E. Fairbrothers s.n.*, 26 September 1978 (CHRB). **D.** *Gentiana saponaria*: *D.B. Snyder 791-5RU* (CHRB).

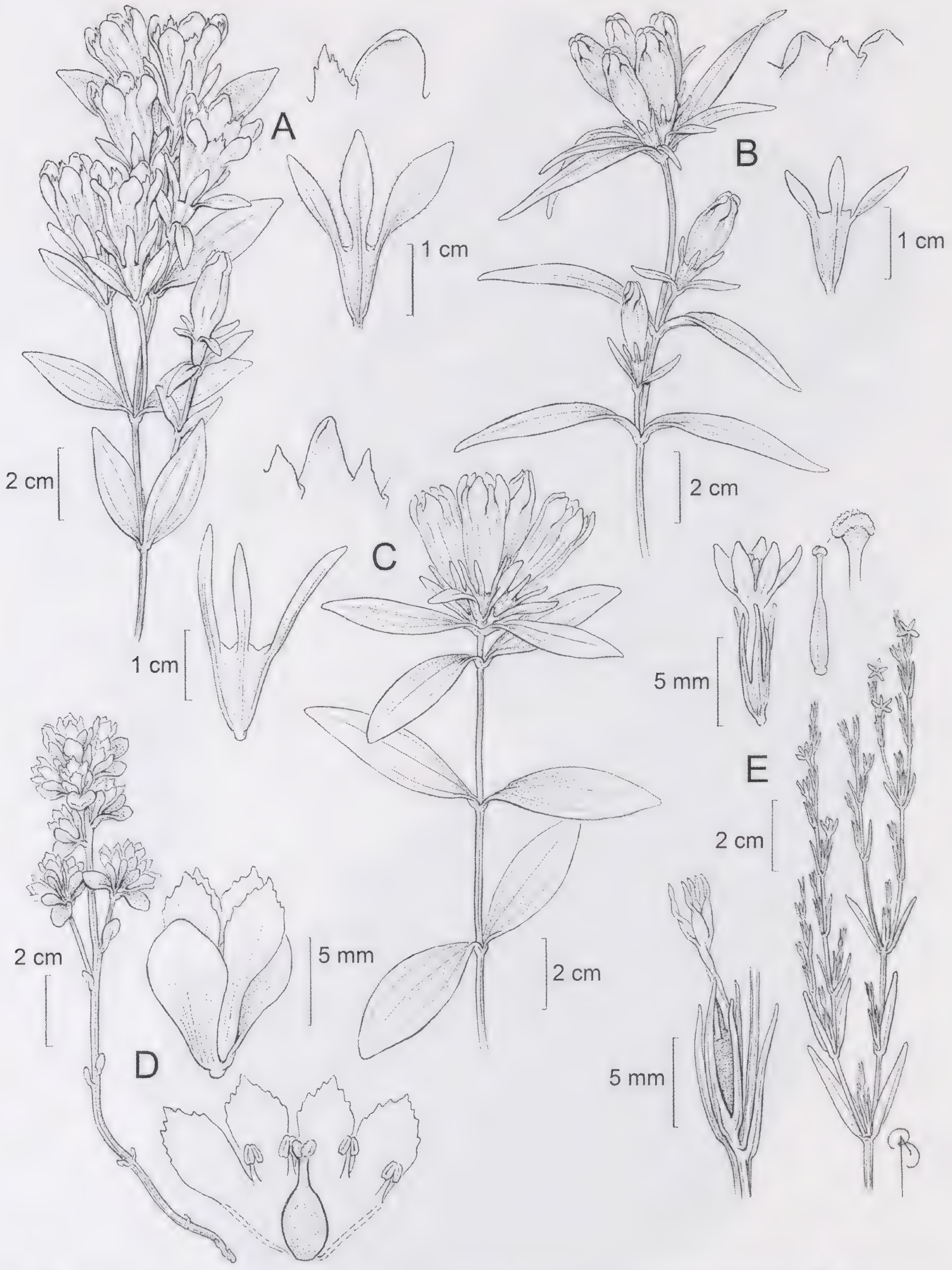

Figure 6. **A.** *Gentiana catesbaei*: *S.W. Leonard and A.E. Radford 2187* (CHRB). **B.** *Gentiana linearis*: *Mori et al. 27467* (NY). **C.** *Gentiana villosa*: *E.J. Grimes 3417* (NY). **D.** *Obolaria virginica*: *B. Long 48720* (PH). **E.** *Schenkia spicata*: *F.C. MacKeever 1033* (NY).

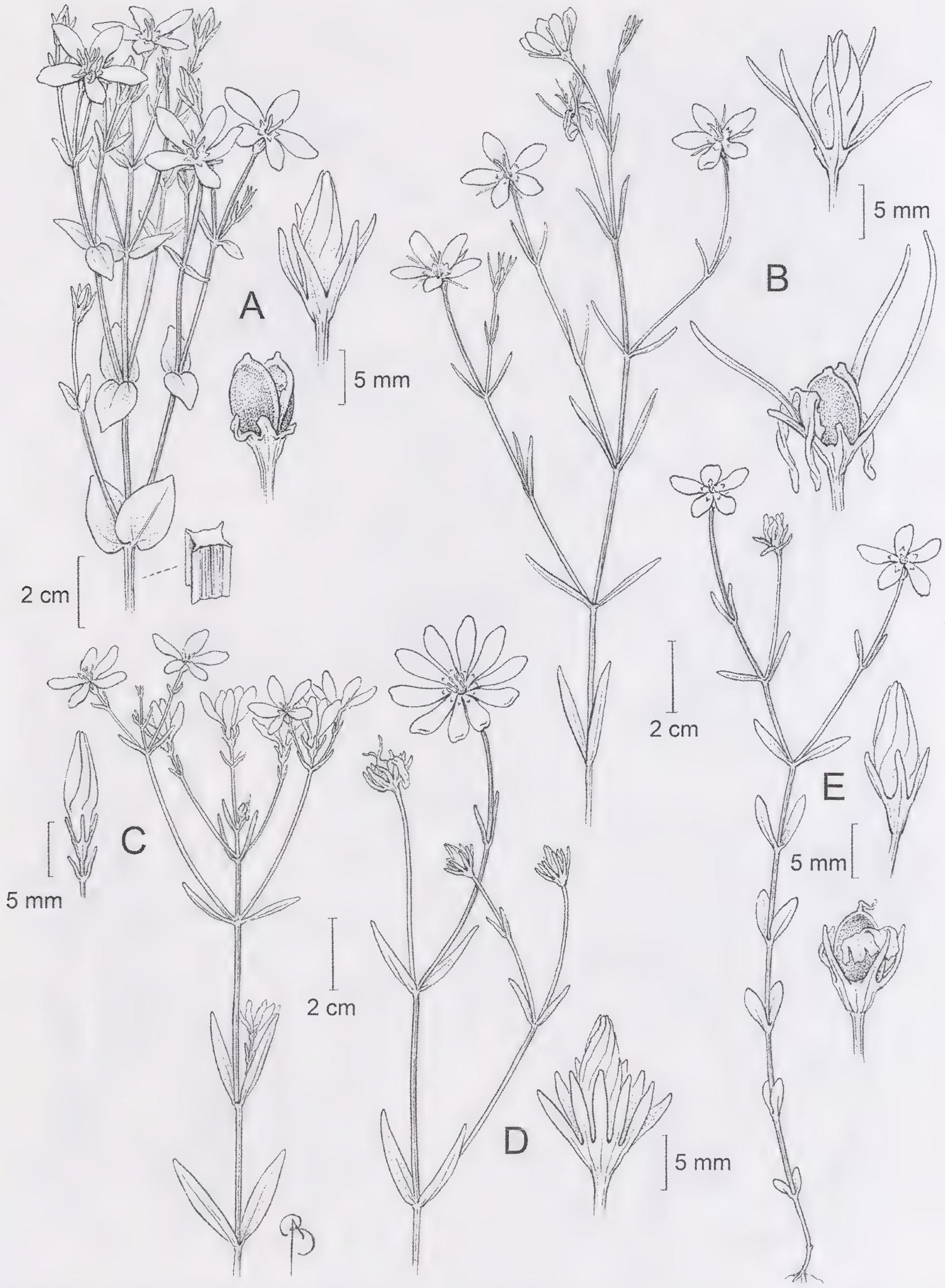

Figure 7. **A.** *Sabatia angularis*: *B. Long 10436* (PH), *J.M. Fogg, Jr. 11638* (PH). **B.** *Sabatia campanulata*: *C.S. Williamson s.n.*, 18 August 1907 (PH), *J.M. Fogg, Jr. 4908* (PH, dup. in NY). **C.** *Sabatia difformis*: *Morton 813* (NY). **D.** *Sabatia dodecandra*: *J.A. Small s.n.*, 4 Augut 1937 (CHRB). **E.** *Sabatia stellaris*: *M.A. Chrysler and M.A. Johnson s.n.*, 12 August 1936 (CHRB), *W. Stone 7524* (PH).

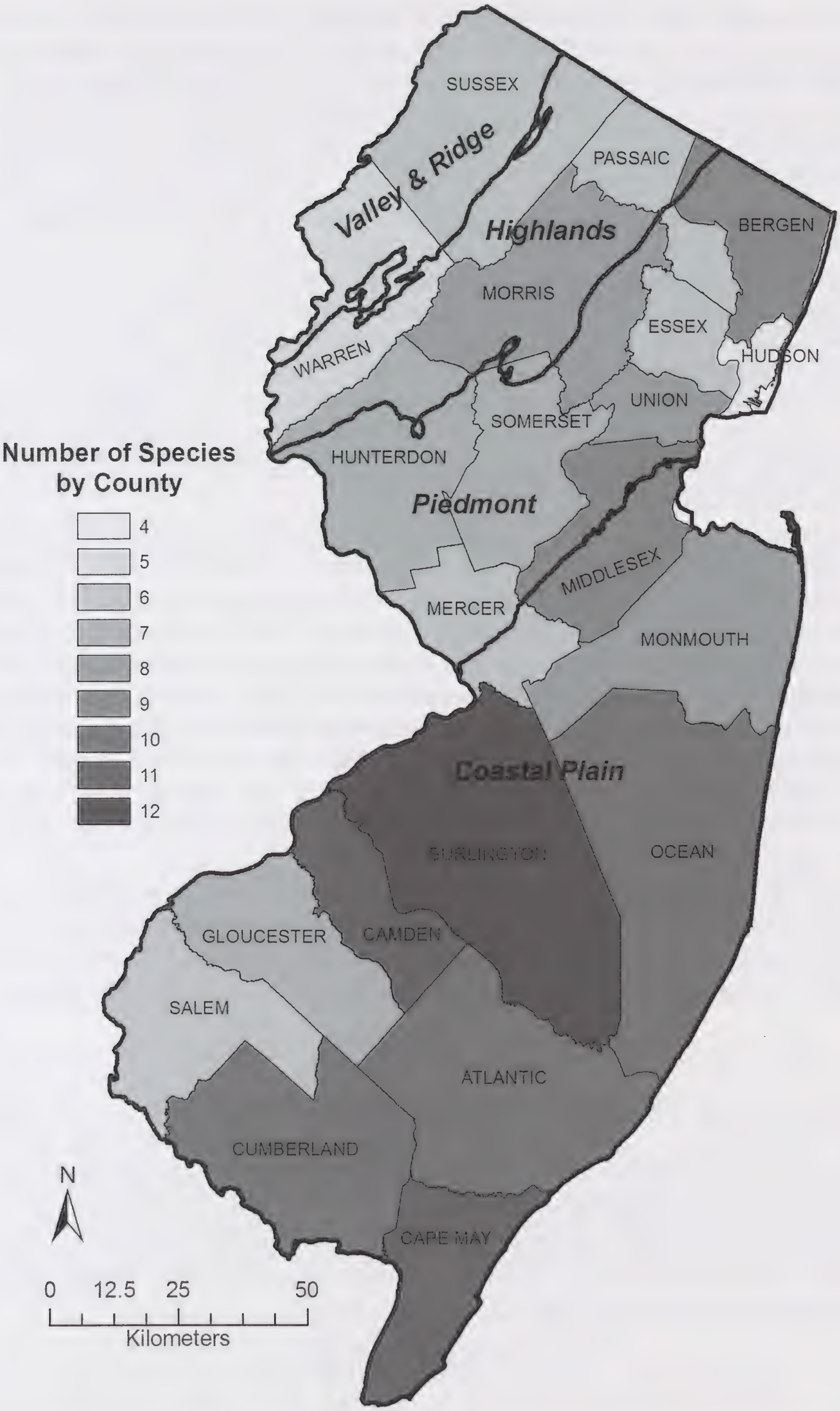

Figure 8. Number of species of Gentianaceae in New Jersey by county (Data Sources: Physiographic provinces—New Jersey Department of Environmental Protection (NJDEP) and New Jersey Geological Society (NJGS); New Jersey counties—New Jersey Office of Information Technology (NJOIT) and Office of Geographic Information Systems (OGIS)).

that *Gentianopsis crinita*, although historically found in 15 counties in New Jersey, is now mostly gone from the Coastal Plain province and restricted to Sussex and Warren counties in the Valley and Ridge province in the northwestern part of the state (Snyder, pers. comm.).

Despite the rarity and uniqueness of species in the Pine Barrens, and the Pine Barrens habitat itself, this region houses the highest diversity of gentianaceous species in New Jersey (Table 4). Of the 19 species of Gentianaceae, 12 occur in Burlington County, 11 in Camden and Cape May counties, and 10 species occur in Atlantic, Cumberland, and Ocean counties. The Pine Barrens region includes all of these counties.

Non-native gentianaceous species do not appear to be a problem as of yet in New Jersey. *Schenkia spicata*, a non-native species, is reported here with a voucher specimen from New Jersey for the first time (Appendix 3). *Centaurium pulchellum*, which has been known to exist in North America for about two centuries, occurs in only six counties, mostly along the coastline of the Atlantic Ocean and the Delaware Bay. Because *C. pulchellum* prefers sandy soils and coastal habitats, it will most likely not become a problem farther inland; however, its populations along the coast should be monitored for invasiveness and competition with native species.

The presence or absence of these gentian species in the counties of New Jersey, as reported here, differs markedly from the most recent county checklist (Hough 1983). Hough (1983) based location information for these species on herbarium specimens only from the Chrysler Herbarium of Rutgers University (CHRB), her own field observations, and those of other reputable botanists. For this paper, location information is based solely on herbarium specimens from four regional herbaria (BKL, CHRB, NY, PH) and does not include undocumented field observations (see Methods). This paper reports 13 of the 19 gentianaceous species as occurring in more counties than were reported by Hough (1983), and five species occurring in the same number of (though not necessarily the same) counties. Hough reported only one species, *Gentianella quinquefolia* subsp. *quinquefolia*, as occurring in more counties than reported here.

The revision of the Gentianaceae family for the Flora of New Jersey Project contributes to providing the first comprehensive manual of all vascular plants occurring in New Jersey. The combination of full species descriptions, nomenclature lists, and a user-friendly online will provide data important information on the plant biodiversity of New Jersey.

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LITERATURE CITED

ANDERSON, K. 2009 (unpublished). Checklist of the Plants of New Jersey. <http://www.cumauriceriver.org/botany/checklist2009.pdf> Accessed 29 Sept. 2014.

BIEN, W. F., J. R. SPOTILA, AND T. GORDON. 2009. Distribution trends of rare plants at the Warren Grove Gunnery Range. *Bartonia* 64:1-18.

BRITTON, N. L. 1881. *A Preliminary Catalogue of the Flora of New Jersey*. Office of the Survey, Rutgers College, New Brunswick, N.J. 233 pp.

BRITTON, N. L., AND .A. BROWN. 1913. *Illustrated Flora of the Northern United States and Canada, Vol. 3*. Charles Scribner's Sons, New York, NY. 637 pp.

DALTON, R. 2003. Physiographic provinces of New Jersey. New Jersey Geological Survey Information Circular, New Jersey Department of Environmental Protection. <http://www.nj.gov/dep/njgs/enviroed/infocirc/provinces.pdf>. Accessed 3 Feb. 2013.

FAIRBROTHERS, D. E. 1964. An annotated chronological bibliography of the floristic publications of New Jersey from 1753–1961. *Bulletin of the Torrey Botanical Club* 91:47-56, 141-151.

FNJP. 2012. Flora of New Jersey Project < http://www.njflora.org/>. Accessed 5 May 2012.

GLEASON, H. A., AND A. CRONQUIST. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada, 2nd edition*. The New York Botanical Garden, New York, NY. 910 pp.

HAINES, A. 2011. *New England Wild Flower Society's Flora Novae Angliae: A Manual for the Identification of Native and Naturalized Higher Vascular Plants of New England*. Yale University Press, New Haven, CT and London, UK. 1008 pp.

HOUGH, M. Y. 1983 (and supplement 1989). *New Jersey Wild Plants*. Harmony Press, Harmony, NJ.

KARTESZ, J. T. 2011. The Biota of North America Program (BONAP). North American Plant Atlas. <http://www.bonap.org/>. Chapel Hill, NC. Accessed 5 May 2012.

KONDO, K. 1970. The chromosome number of *Obolaria virginica* L. (Gentianaceae). *Rhodora* 72:551-553.

MANSION, G. 2004. A new classification of the polyphyletic genus *Centaurium* Hill (Chironiinae, Gentianaceae): description of the New World endemic *Zeltnera*, and reinstatement of *Gyrandra* Griseb. and *Schenkia* Griseb. *Taxon* 53:719-740.

MANSION, G., AND L. STRUWE. 2004. Generic delimitation and phylogenetic relationships within the subtribe Chironiinae (Chironieae: Gentianaceae) with special reference to *Centaurium*: evidence from nrDNA and cpDNA sequences. *Molecular Phylogenetics and Evolution* 32:951-977.

MELDERIS, A. 1972. Taxonomic studies on the European species of the genus *Centaurium* Hill. In: V. H. HEYWOOD (ed.). Flora Europaea notulae systematicae ad Floram Europaeam spectantes. *Botanical Journal of the Linnean Society* 65:224-250.

NATIONAL WETLAND PLANT LIST. 2012. United States Department of Agriculture, Natural Resources Conservation Service. < http://plants.usda.gov/wetland.html>. Accessed 12 Jan. 2013.

NJDEP. 2011. New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Endangered and Nongame Species. New Jersey Administrative Code Amendement (N.J.A.C.) 7:25-4.1, 4.13, 4.17. 2011. <http://www.nj.gov/dep/rules/proposals/011811b.pdf>. Accessed 15 Jan. 2013.

NEW JERSEY HIGHLANDS COUNCIL. 2004. *Highlands Water Protection and Planning Act*. New Jersey Highlands Council, Chester, NJ.

NEW JERSEY NATURAL HERITAGE PROGRAM. 2010. List of Endangered Plant Species and Plant Species of Concern January 2010.
<www.nj.gov/dep/parksandforests/natural/heritage/spplant.html>. Accessed 5 May 2012.

NEW JERSEY PINELANDS COMMISSION. 2007. *Comprehensive Management Plan for the Pinelands National Reserve and Pinelands Area*. New Jersey Pinelands Commission, New Lisbon, NJ.

PERRY, J. D. 1971. Biosystematic studies in the North American genus *Sabatia* (Gentianaceae). *Rhodora* 73:309-369.

PRINGLE, J. S. 1963. A systematic survey of the section *Pneumonanthae* of *Gentiana* in eastern North America. Ph.D. dissertation, University of Tennessee. Knoxville, TN.

PRINGLE, J. S. 1969. Documented plant chromosome numbers 1969: 1. *Sida* 3:350-351.

PRINGLE, J. S. 2007. Authorship of the name *Centaurium pulchellum* (Gentianaceae). *The Michigan Botanist*. 46:63-64.

RHOADS, A. F., AND T. A. BLOCK. 2007. *The Plants of Pennsylvania: An Illustrated Manual, second edition*. University of Pennsylvania Press, Philadelphia, PA.

PRINGLE, J.S., L. S. POSTER, AND L. STRUWE. 2015. Nomenclature and typification of the Gentianaceae in New Jersey. *Bartonia* 67:35-57.

RORK, C. L. 1949. Cytological studies in the Gentianaceae. *American Journal of Botany* 36:687-701.

STONE, W. 1911. *The plants of southern New Jersey with especial reference to the flora of the Pine Barrens and the geographic distribution of the species*. Annual Report of the New Jersey State Museum for 1910, part II: 21-828. Trenton, NJ.

STRUWE, L., J. W. KADEREIT, J. KLACKENBERG, S. NILSSON, M. THIV, K. B. VON HAGEN, AND V. A. ALBERT. 2002. Systematics, character evolution, and biogeography of Gentianaceae, including a new tribal and subtribal classification. pp. 21-309. In: L. Struwe & V. A. Albert (eds.). *Gentianaceae: Systematics and Natural History*. Cambridge University Press, Cambridge, UK.

USDA PLANTS DATABASE. 2013. United States Department of Agriculture, Natural Resources Conservation Service. < http://plants.usda.gov/java/>. Accessed 25 Jan. 2013.

ZELTNER, L. 1970. Recherches biosystématique sur les genres *Blackstonia* Huds. et *Centaurium* Hill. *Bulletin de la Société Neuchâteloise des Sciences Naturelles* 93:1-164.

ZELTNER, L. 1987. Contribution à l'étude cytogéographique des genres *Blackstonia* Huds. et *Centaurium* Hill (Gentianaceae) en USSR. *Bulletin de la Société Neuchâteloise des Sciences Naturelles* 110:17-35.

ZELTNER, L. 1991. Contribution à l'étude cytogéographique des genres *Blackstonia* Huds. et *Centaurium* Hill (Gentianaceae) en Turquie, à Rhodes et à Chypre. *Bulletin de la Société Neuchâteloise des Sciences Naturelles* 114:77-103.

APPENDIX 1.

CONSERVATION CLASSIFICATION AND ENDANGERMENT CODES USED IN TABLE 1

Global and State Ranks: The Nature Conservancy developed a ranking system for use in identifying elements (rare species and ecological communities) of natural diversity most endangered with extinction. Each element is ranked according to its global, national, and state rarity. These ranks are used to prioritize work so that the most endangered elements receive attention first. Definitions for element ranks are after the Nature Conservancy (1982: Chapter 4, 4.1-1 through 4.4.1.3-3).

Note: To express uncertainty, the most likely rank is assigned and a question mark added (e.g., G2?). A range is indicated by combining two ranks (e.g., G1G2, S1S3).

Global Element Ranks

G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; with the number of occurrences in the range of 21 to 100.

G4 = Apparently secure globally; although it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally; although it may be quite rare in parts of its range, especially at the periphery.

T = Element ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species.

State Element Ranks

S2 = Imperiled in New Jersey because of rarity (6 to 20 occurrences). Historically many of these elements may have been more frequent but are now known from very few extant occurrences, primarily because of habitat destruction. Diligent searching may yield additional occurrences.

S3 = Rare in state with 21 to 50 occurrences. Includes elements that are widely distributed in the state but with small populations or elements with restricted distribution, but locally abundant. Not yet imperiled in state but may soon be if current trends continue. Searching often yields additional occurrences.

SH = Elements of historical occurrence in New Jersey. Despite some searching of historical occurrences and/or potential habitat, no extant occurrences are known. Since not all of the historical occurrences have been field surveyed, and unsearched potential habitat remains, historically ranked taxa are considered possibly extant, and remain a conservation priority for continued field work with the expectation they may be rediscovered.

SX = Elements that have been determined or are presumed to be extirpated from New Jersey. All historical occurrences have been searched and a reasonable search of potential habitat has been completed. Extirpated taxa are not a current conservation priority.

.1 = Elements only ever documented from a single location.

State Status Codes: According to the Endangered and Nongame Species Conservation Act of 1973 (NJDEP 2011).

E = Endangered species—an endangered species is one whose prospects for survival within the state are in immediate danger due to one or many factors—a loss of habitat, over exploitation, predation, competition, disease. An endangered species requires immediate assistance or extinction will probably follow.

Regional Status Codes:

LP—indicates taxa listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction (New Jersey Pinelands Commission 2007).

HL—indicates taxa or ecological communities protected by the Highlands Water Protection and Planning Act within the jurisdiction of the Highlands Preservation Area (New Jersey Highlands Council 2004).

APPENDIX 2.

CATEGORIES USED FOR NATIONAL WETLAND INDICATOR STATUS USED IN TABLE 3

(NATIONAL WETLAND PLANT LIST 2012)

Indicator Code	Indicator Status	Comment
OBL	Obligate Wetland	Almost always is a hydrophyte, rarely in uplands
FACW	Facultative Wetland	Usually is a hydrophyte but occasionally found in uplands
FAC	Facultative	Commonly occurs as either a hydrophyte or non-hydrophyte
FACU	Facultative Upland	Occasionally is a hydrophyte but usually occurs in uplands
UPL	Obligate Upland	Rarely is a hydrophyte, almost always in uplands

APPENDIX 3.

LIST OF REPRESENTATIVE SPECIMENS BY COUNTY IN NEW JERSEY, USA.

Herbarium abbreviations follow Index Herbariorum.
* = only specimen record of this species from this county
** = only specimen record of this species from the state of New Jersey

Bartonia paniculata (Michx.) Muhl. subsp. ***paniculata***
Atlantic: *B. Long 52956* (PH); Burlington: *H. Koster E4-5-1* (PH); Camden: *W. Stone 7584* (PH)
Cape May: *F. Pennell s.n.*, 2 Sept 1915 (NY); Cumberland: *S. Heckscher 4* (PH); Gloucester: *B. Long 25066* (CHRB, PH); Mercer: *E. B. Bartram s.n.*, 19 Sept 1913 (PH); Middlesex: *K. Mackenzie 2929* (NY); Monmouth: *B. Long 57253* (CHRB); Ocean: *G. Moore 8151* (BKL)
Salem: *Beals and Bassett 948* (NY, PH)

Bartonia virginica (L.) Britton, Sterns & Poggenb.
Atlantic: *F. Pennell 8164* (PH); Bergen: *K. Mackenzie 2479* (NY); Burlington: *B. Long 70763* (CHRB, PH); Camden: *B. Long* 54950 (PH); Cape May: *H. Wilkens 4887-a* (PH); Cumberland: *G. Moore 6721* (BKL); Essex: *P. Wilson s.n.*, 3 July 1905 (NY); Gloucester: *B. Long 28130* (PH); Hudson: *W. Leggett s.n.*, 9 Nov 1867 (CHRB)*; Hunterdon: *B. Long 52993*, 1938(PH)*; Middlesex: *W. Miller 1350* (NY, CHRB); Monmouth: *W. Miller 1347* (NY); Morris: *K. Barringer 15812* (BKL); Ocean: *E. B. Bartram 3681* (PH); Passaic: *H. Denslow*

s.n., 2 Aug 1929 (NY); Salem: *J. Fogg, Jr. 9457* (PH); Sussex: *R. Clausen and J. Edwards 3542* (CHRB); Union: *K. Barringer 19265* (BKL); Warren: *R. Schaeffer, Jr. 41547* (PH)

Centaurium pulchellum (Sw.) Hayek ex Hand.-Mazz. et al.
Atlantic: *V. Abraitys s.n.*, 1 July 1974 (CHRB); Bergen: *C. F. Austin s.n.*, 1857 (CHRB); Camden: *A. Jahn s.n.*, 10 July 1900 (PH)*; Cape May: *K. Mackenzie 6133* (CHRB, PH); Hudson: *K. Barringer* 12143 (BKL); Ocean: *B. Long* 9162 (PH, CHRB)

Gentiana andrewsii Griseb. var. ***andrewsii***
Bergen: *K. K. Mackenzie 7445* (NY); Burlington: *K. K. Mackenzie 6849*, 1915 (NY)*; Camden: *A. McElwee 678* (PH); Hunterdon: *G. A. Loughridge and W. E. Roever 462* (CHRB); Mercer: *B. Long 17838* (PH); Middlesex: *A. P. Kelley 709* (CHRB); Morris: *J. Kezer s.n.*, 21 Sept 1926 (NY); Somerset: *A. P. Kelley s.n.*, 25 Sept 1926 (CHRB)*; Sussex: *H. S. 11682* (BKL); Union: *W. DeWitt Miller 1351* (NY)*

Gentiana autumnalis L.
Atlantic: *J. C. Lendemer 1439* (PH, BKL); Burlington: *R. T. Clausen and W. Wilson 2371* (BKL, NY); Camden: *W. H. Witte s.n.*, 21 Sept 1929 (PH); Cape May: *B. Long 5176* (PH); Cumberland: *J. R. Pennell s.n.*, 11 Sept 1924 (BKL, NY, PH); Ocean: *R. T. Clausen 5656* (NY)

Gentiana catesbaei Walter
Somerset: *H. N. Moldenke 3105* (NY)**

Gentiana clausa Raf.
Bergen: *F. W. Pennell s.n.*, 12 Sept 1915 (NY); Burlington: *B. Long 17807* (PH); Essex: *H. H. Rusby s.n.*, Aug 1879 (CHRB)*; Hunterdon: *W. M. Benner 9015* (PH); Middlesex: *S. J. Ewer s.n.*, 3 Oct 1931 (CHRB); Monmouth: *B. Long 22471* (PH); Morris: *H. N. Moldenke 6426* (NY); Passaic: *H. M. Denslow s.n.*, 17 Sept 1923 (NY); Somerset: *J. Kezer 10* (CHRB); Sussex: *K. Barringer 7355* (BKL); Union: *J. Kezer s.n.*, 28 Sept 1940 (CHRB)*; Warren: *E. T. Moul 63-198* (CHRB)

Gentiana linearis Froel.
Passaic: *R. T. Clausen 5568* (NY)**

Gentiana saponaria L.
Atlantic: *B. Long 18346* (CHRB, PH); Bergen: *C. Ericson 2255* (BKL); Burlington: *H. Koster E4-3-2* (PH); Camden: *J. M. Fogg, Jr. 604* (PH); Cape May: *B. Long 7972* (PH); Cumberland: *G. Moore 7712* (BKL); Essex: *C. Ericson 1375* (BKL); Gloucester: *B.Long 18291* (NY, CHRB); Hunterdon: *B.Long 55685* (CHRB, PH); Mercer: *W. M. Rankin s.n.*, 10 Oct 1884 (CHRB); Middlesex: *K. K. Mackenzie 3912* (NY); Monmouth: *K. K. Mackenzie 8209* (NY, CHRB); Morris: *W. DeWitt Miller 1358* (NY); Ocean: *J. M. Fogg, Jr. 13955* (PH)*; Passaic: *G. V. Nash 463* (NY); Salem: *J. M. Fogg, Jr. 6203* (PH); Somerset: *L. Lighthipe s.n.*, 19 Sept 1919 (BKL); Union: *J. Kezer s.n.*, 6 Oct 1940 (CHRB)

Gentiana villosa L
Cumberland: *N. L. Britton s.n.*, 23 Sept 1881 (CHRB)**

Gentianella quinquefolia (L.) Small subsp. ***quinquefolia***
Morris: *T. C. Porter s.n.*, 26 Sept 1869 (CHRB)*; Passaic: *H. M. Denslow s.n.*, 13 Oct 1922 (NY); Sussex: *A. J. Hoiberg 920* (CHRB); Warren: *H. W. Pretz 9220* (CHRB, PH)

Gentianopsis crinita (Froel.) Ma
Bergen: *N. Taylor 451* (BKL); Camden: *W.Stone 13709* (CHRB); Cape May: *B. Long 25034* (PH, CHRB); Essex: *M. W. Travis s.n.*, 20 Oct 1936 (CHRB); Gloucester: *B. Long 38895* (PH); Hunterdon: *E. A. Laport s.n.*, 23 Sept 1969 (CHRB); Mercer: *W. L. Dix s.n.*, 22 Sept 1946 (PH); Middlesex: *C. Ericson 3073* (BKL); Monmouth: *Anonymous s.n.*, 28 Sept 1958 (CHRB)*; Morris: *M. A. Chrysler s.n.*, 12 Oct 1934 (CHRB); Passaic: *J. A Small s.n.*, 24 Sept 1933 (CHRB)*; Somerset: *M. A. Chrysler s.n.*, 6 Oct 1933 (CHRB); Sussex: *S. Glenn 5146a* (BKL); Union: *F. Tweedy s.n.*, Sept 1889 (CHRB)*;Warren: *R. L. Schaeffer, Jr. 36979* (PH)

Obolaria virginica L.
Camden: *L. P. Hynes s.n.*, 23 Apr 1938 (PH)*; Cumberland: *B. Long 42928* (PH)*; Essex: *K. K. Mackenzie s.n.*, 29 Apr 1923 (NY); Gloucester: *F. Hirst s.n.*, 9 May 1961 (PH); Hunterdon: *G. A. Loughridge 2270* (PH); Mercer: *H. M. Denslow s.n.*, 7 June 1924 (NY); Morris: *D. B. Snyder 424-2RU* (CHRB); Salem: *J. A. Waddington s.n.*, 5 May 1888 (PH)*; Somerset: *H. N. Moldenke 11068* (NY); Sussex: *H. H. Rusby s.n.*, s.d. "Franklin" (NY)*; Union: *H. Baldwin s.n.*, 1923 (NY)*

Sabatia angularis (L.) Pursh
Atlantic: *B. Long 10436* (PH); Bergen: *C. F. Austin s.n.*, 4 Jan 1883 (CHRB); Burlington: *R. E. Good and W. R. Ferren 435* (CHRB)*; Camden: *L. P. Hynes 1430* (PH); Cape May: *B. Long 4424* (PH, CHRB); Cumberland: *B. Long 44581* (PH); Essex: *K. K. Mackenzie 355* (NY); Gloucester: *B. Long 28345* (PH); Hunterdon: *W. M. Benner 6787* (PH); Mercer: *B. Long 48888* (PH); Middlesex: *W. DeWitt Miller 1361* (NY); Monmouth: *V. L. Frazee s.n.*, 4 Aug 1952 (PH)*; Morris: *C. Hall s.n.*, Sept 1875 (BKL); Ocean: *J. H. Grove 762* (PH); Somerset: *H. N. Moldenke 6173* (NY); Union: *C. Ericson 1698* (BKL); Warren: *R. L. Schaeffer, Jr. 29686* (PH)

Sabatia campanulata (L.) Torr.
Atlantic: *C. A. Gross s.n.*, 4 Aug 1887 (NY); Burlington: *B. Long 10669* (CHRB); Cape May: *W. Stone 16300* (PH); Cumberland: *B. Long 47155* (CHRB, PH); Monmouth: *K. K. Mackenzie 5144* (CHRB, NY, PH); Ocean: *J. M. Fogg, Jr. 4908* (NY, PH); Salem: *B. Long 47088* (PH)

Sabatia difformis (L.) Druce
Atlantic: *W. Stone 14360* (PH); Burlington: *K. Barringer 12259* (BKL, PH); Camden: *Bayard Long 54939* (PH); Cape May: *D. W. Hamm 1267* (CHRB); Cumberland: *B. Long 51297* (CHRB, PH); Ocean: *T. W. Edmondson 4868* (NY)

Sabatia dodecandra (L.) Britton, Sterns & Poggenb.
Atlantic: *B. Long 10486* (NY, PH); Bergen: *G. V. Nash 46* (NY); Burlington: *D. B. Snyder 818-3RU* (CHRB); Cape May: *W. Stone 9148* (CHRB); Hudson: *W. Van Sickle s.n.*, 28 July 1894 (BKL); Middlesex: *C. Ericson 3374* (BKL); Ocean: *J. M. Fogg, Jr. 11110* (PH)

Sabatia stellaris Pursh
Atlantic: *J. M. Fogg, Jr. 4574* (PH); Bergen: *H. H. Rusby s.n.*, July 1879 (NY)*; Burlington: *H. N. Moldenke 3270* (NY); Camden: *C. F. Parker s.n.*, 26 Aug 1969 (CHRB); Cape May: *F. S. Fender 803* (PH); Cumberland: *J. W. Adams 1124* (PH); Hudson: *K. K. Mackenzie 6765* (CHRB, PH); Middlesex: *C. Ericson 3308* (BKL); Monmouth: *K. K. Mackenzie 1839* (NY); Ocean: *K. K. Mackenzie 2388* (NY); Salem: *J. M. Fogg, Jr. 6098* (PH)

Schenkia spicata (L.) G. Mans.
Union: *L. Kelly s.n.*, 29 Aug 2012 (CHRB)**

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Nomenclature and Typification of the Gentianaceae in New Jersey

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ABSTRACT. Presented here are generic and specific nomenclature, typifications, and taxonomic updates on all of the species of Gentianaceae (Asteridae: Gentianales) occurring naturally in the state of New Jersey, U.S.A. Complete synonymy is provided (except for formae), along with all known information on typifications. A type is designated for *Erythraea* sect. *Spicaria* Griseb.; neotypes are designated for *Gentiana clausa* Raf., G. *linearis* Froel., and G. *ochroleuca* Froel.; and lectotypes are designated for *Chironia gracilis* Michx., *C. paniculata* Michx., *Diploma angustifolia* Raf., *Gentiana andrewsii* var. *intermedia* Kusn., G. *elliottii* var. *parvifolia* Chapm., *G. incarnata* Sims, *G. intermedia* Sims, *G. pseudopneumonanthe* Schult., and *Sabatia stellaris* Pursh. The typification of *Centaurium pulchellum* (Sw.) Hayek ex Hand.-Mazz. et al. is clarified.

Keywords: Gentianaceae, New Jersey, nomenclature, taxonomy, typification

INTRODUCTION

This paper supplements *Identification and Descriptions of the Gentianaceae in New Jersey* (Poster et al. 2015). Here we provide a list of the accepted names for the gentian species native to or naturalized in New Jersey, U.S.A., with bibliographical data, homotypic and heterotypic synonymy (except for named forms distinguished by corolla color or by abortive or cleistogamous flowers), and typifications. All species of Gentianaceae in New Jersey have distributions outside the state, and therefore this treatment and its clarifications on typifications will be useful for botanical taxonomy in large parts of eastern United States, as well as Europe for some boreal species.

Several authors of scientific names applied to gentianaceous species native to North America lived for a time in or near Philadelphia, Pennsylvania, namely G.H.E. Muhlenberg, Frederick Pursh, L.D. de Schweinitz, and C.S. Rafinesque. The principal repository of specimens studied by the first three is the herbarium of the Academy of Natural Sciences of Drexel University (PH). The authors of this paper have visited that herbarium, searched its holdings for specimens relevant to the typification of names for New Jersey gentians, and discussed this topic with PH staff members.

There is a large body of literature on Rafinesque, who has long been of great interest to historians of science. Many searches have been made for specimens collected or annotated by Rafinesque, but few have been found. Little of Rafinesque's own herbarium has been preserved. Some specimens associated with Rafinesque are at PH, although they are few in proportion to the large number of "species" named by him (Stuckey 1971). We have searched the PH herbarium for such specimens relevant to the present study, including all of the historic collections. Dr. Alfred E. Schuyler provided valued information on which of the existing specimens at PH Rafinesque would likely have seen. Also, Rafinesque studied and annotated gentianaceous specimens in the herbarium of John Torrey, which are now at NY (Pringle 2003), and other specimens associated with Rafinesque are at DWC. We have also studied those specimens. The identity of the species to which some names were given by Rafinesque has of necessity been determined *ex char.*, not always with certainty, in the absence of any extant specimens so identified by him. We have determined, however, that all of the gentianaceous species known from regions where Rafinesque had found plants to which he gave untypified names now bear specific epithets that would have priority over those used by Rafinesque.

Some names for northern North American Gentianaceae were published by A.H.R. Grisebach (1837), who prepared the treatment of the family for W.J. Hooker's *Flora Boreali-Americana* and for A.P. and Alphonse de Candolle's *Prodromus* (Grisebach 1845), as well as a monograph on the family (Grisebach 1838). Grisebach, who did not visit North America, obtained his knowledge of North American Gentianaceae largely from specimens in Hooker's herbarium, which is now at K, where they have been studied by the first author. Hooker shared many of his acquisitions with Asa Gray, whose herbarium is now at Harvard University (GH), where the specimens relevant to Grisebach's work have been seen by the first author.

The typification of plant names published by Thomas Walter has been extensively studied by several authors, most notably by Daniel B. Ward, whose publications that pertain to the present study are cited below. The first author has communicated with Dr. Ward on several occasions with regard to names applied to gentianaceous species, and has examined images of specimens collected and/or studied by Walter.

New combinations published by J.K. Small in his *Flora of the Southeastern United States* (Small 1903) first appear in that work with the descriptions of the respective species, but the requirements for valid publication as of 1903, i.e., the indication of the basionym, are fulfilled in the appendix. In nomenclatural contexts it is a common practice, followed here, to cite both pages of this work, lest it be inferred from an examination of the first appearance of the new combination that it was not validly published.

Bartonia Muhl. ex Willd., Ges. Naturf. Freunde Berlin Neue Schriften 3: 444. 1801. ORIGINAL TYPE: *Bartonia tenella* Muhl. ex Willd. (= *B. virginica* (L.) Britton, Sterns & Poggenb.). Only species associated with *Bartonia* by Willdenow in the protologue.

Centaurella Michx., Fl. Bor.-Amer. 1: 97. 1803, illegitimate homonym, non Delarbre, Fl. Auvergne, ed. 2, 28. 1800.

Centaurium Pers., Syn. Pl. 1: 137. 1805, illegitimate homonym, non Hill, Brit. Herb. 62. 1756.

Andrewsia Spreng., Anleit. Kenntn. Gew., ed. 2, 2(1): 474. 1817, illegitimate homonym, non *Andreusia* Vent., Jard. Malmaison t. 108. 1805 ("1804").

Bartonia paniculata (Michx.) Muhl., Cat. Pl. Amer. Sept. 16. 1813.

Centaurella paniculata Michx., Fl. Bor.-Amer. 1: 98. 1803; *Andrewsia paniculata* (Michx.) Barton ex Steud., Nomencl. Bot, ed, 2, 1: 87. 1840, pro syn.; *Bartonia virginica* var. *paniculata* (Michx.) B. Boivin, Naturaliste Canad. 93: 1059. 1966. LECTOTYPE: A. *Michaux s.n., s.d.*, U.S.A.: Carolina (P-Richard, photo DAO!). Designated by J.M. Gillett, Rhodora 61: 53. 1959.

Centaurium autumnale Pers., Syn. Pl. 1: 137. 1805, specific epithet superfluous, based on *Centaurella paniculata* Michx., Fl. Bor.-Amer. 1: 98. 1803.

New Jersey plants are:

Bartonia paniculata subsp. ***paniculata***

Bartonia tenella Muhl. ex Willd. [var.] β *brachiata* Alph. Wood, Class-book Bot., ed. 41 revised, 586. 1866, sensu Alph. Wood, non quoad typum; based on *B. moseri* (Steud. & Hochst. ex Griseb.) B.L. Rob. & Schrenk ex Gilg (discussed below).

Bartonia lanceolata Small, Fl. S.E. U.S., ed. 1: 932, 1336. 1903. ORIGINAL TYPE: *A.W. Chapman s.n, s.d.*, U.S.A.: Florida: Calhoun Co.: Ocheesee (NY [image online!]). Designated in the protologue.

Bartonia virginica (L.) Britton, Sterns & Poggenb., Prelim. Cat. 36. 1888.

Sagina virginica L., Sp. Pl. 2: 28. 1753. LECTOTYPE: *J. Clayton 649, s.d.*, U.S.A.: Virginia (lectotype BM [image online!, photo DAO!]). Designated by J.M. Gillett, Rhodora 61: 49. 1959.

Bartonia tenella Muhl. ex Willd., Ges. Naturf. Freunde Berlin Neue Schriften 3: 444. 1801; LECTOTYPE: *G.H.E. Muhlenberg s.n., s.d.*, U.S.A.: Pennsylvania (B-Willd. [photo DAO!]). Designated by J.M. Gillett, Rhodora 61: 49. 1959.

Centaurella autumnalis Pursh, Fl. Amer. Sept. 1: 100. 1813 ("1814"), specific epithet superfluous, included *Sagina virginica* L.; *Andrewsia autumnalis* (Pursh) Spreng., Syst. Veg. 1: 428. 1825.

Centaurella autumnalis [var.] β *brachysepala* Griseb., Gen. Sp. Gent. 308. 1838 ("1839"). TYPE: Not designated by Grisebach in the protologue; discussed under *C. moseri*, below.

Centaurella moseri Steud. & Hochst. ex Griseb., Gen. Sp. Gent. 308. 1838 ("1839"); *Bartonia moseri* (Steud. & Hochst. ex Griseb.) B.L. Rob. & Schrenk ex Gilg in Engl. & Prantl, Nat. Pflanzenf. 4, abt. 2: 76. 1895. TYPE: Not designated by Grisebach in the protologue; discussed below.

The names *Centaurella autumnalis* var. *brachysepala* and *C. moseri* were published simultaneously (Grisebach 1838). Grisebach distinguished these taxa primarily by their branching and leaf arrangement, with the branching of *C. autumnalis*, including var. *brachysepala*, being opposite and that of *C. moseri* being alternate. With both of these names Grisebach cited specimens from Pennsylvania collected by C.J. Moser and specimens allegedly from the vicinity of Covington, Louisiana, collected by T. Drummond. In both cases the specimens had been distributed by the Unio Itineraria, a nineteenth-century organization based in Württemburg, Germany, for the collection and distribution of botanical specimens. The Moser collection had been

distributed under the name *C. moseri*, a then-unpublished name coined by Steudel and Hochstetter, directors of the Unio Itineraria.

Replicates of the Drummond collection are at MO and NY, and a replicate of the Moser collection is at GH. All of these specimens have been identified by Gillett (1959) and by us as *Bartonia virginica*. The extreme rarity of *B. virginica* in Louisiana raises suspicions as to the accuracy of the provenance associated with that collection.

Grisebach did not state where he had seen replicates of either of these collections. It is highly unlikely that he saw any of those that are now, and probably were in his time, in American herbaria. Even assuming that Grisebach had not made an error in copying or editing, and that both Drummond and Moser had collected material that Grisebach considered to be mixed, with both names having been based on the same two collections there is no adequate basis for determining which of the extant replicates that Grisebach did not see should be associated, respectively, with each of the two names published by Grisebach.

Gillett (1959) speculated that a replicate of the Drummond collection, which could be considered the type of the name *Centaurella autumnalis* var. *brachysepala*, might exist in London. (Many of Drummond's collections and some of Moser's are at K.) He also speculated that a replicate of the Moser collection, which could be considered the type of the name *C. moseri*, might be at STU. The online data bases of K and STU, however, list no Drummond or Moser collections at either herbarium that could be identified with *Bartonia*. This speculation about whether certain specimens existed (which data now available suggest they probably did not) hardly constituted even a first step in the process of lectotypification, and Gillett (1959) clearly indicated that it was not so intended.

Taxonomic studies of *Bartonia* by Gillett (1959), Mathews et al. (2009), ourselves, and others have not recognized any taxon to which either of these names or its epithet might correctly be applied at any rank, regardless of how these names might be typified. We have, therefore, followed Gillett in refraining from designating lectotypes for these names.

Bartonia tenella Muhl. ex Willd. [var.] β *brachiata* Alph. Wood, Class-Book Bot., ed. 41 revised, 586. 1861, excluding description; based on *B. moseri* (Steud. & Hochst. ex Griseb.) B.L. Rob. & Schrenk ex Gilg.

Centaurium Hill, Brit. Herb. 62. 1756.

DESIGNATED TYPE: *Gentiana centaurium* L. (= *Centaurium littorale* (Turner) Gilmour). Designated by J.M. Gillett, Res. Branch Canada Dept. Agric. Publ. 1180: 72. 1963 (see Mansion 2004).

Erythraea Borkh., Arch. Bot. (Leipzig) 1(1): 30. 1796, superfluous name, included type of *Centaurium* Hill.

Centaurella Delarbre, Fl. Auvergne, ed 2, 28. 1800, superfluous name, included type of *Centaurium* Hill.

Hippocentaurea Schult., Oestr. Fl., ed. 2, 1: 388. 1814; superfluous name, included type of *Centaurium* Hill.

Gonipia Raf., Fl. Tellur. 3: 23. 1837; superfluous name, included type of *Centaurium* Hill.

Centaurodes Möhring ex Kuntze. Rev. Gen. Pl. 426. 1891, superfluous name, included type of *Centaurium* Hill.

Centaurium pulchellum (Sw.) Hayek ex Hand.-Mazz. et al., Oesterr. Bot. Z. 56: 70. 1906.

Gentiana pulchella Sw., Kongl. Vetensk. Acad. Nya Handl. 4: 86. 1783; *Chironia pulchella* (Sw.) Willd., Sp. Pl. 1: 1067. 1798; *Exacum pulchellum* (Sw.) Pursh, Fl. Amer. Sept. 1: 100. 1813 ("1814"); *Erythraea pulchella* (Sw.) Fr., Novit. 74. 1814; *E. ramosissima* [var.] β *pulchella* (Sw.) Griseb. (attrib. to Fr.), Gen. Sp. Gent. 137. 1838 ("1839"). LECTOTYPE: *O. Swartz s.n., s.d.*, "Ålandia, paroecia Finstroem" (= Finland, prov. Auland) (lectotype S, catalogue number S10-26105 [image online!], isolectotype UPS, catalogue number V-006641, n.v.). Designated here.

Swartz's own herbarium, the most significant repository of his type specimens, is now at S. Stafleu and Cowan (1986) listed many other herbaria known to contain specimens collected by Swartz, but only S, BM, and LD were noted as being likely repositories of types. We have searched the online database of the Virtuella Herbariet project, which contains data from six Swedish herbaria including S, LD, and UPS, the databases of B and BM, and the specimens at PH and NY, and have located only two collections (one with two replicates) of *Centaurium pulchellum* that had been collected by Swartz. Only the collection cited above, at S and UPS, bears the same locality data as those given in the protologue. The other specimen, which is at UPS, is from the island of Gotland, Sweden. It had originally been identified as *Erythraea ramosa* [sic] by Swartz (*in herb.*), suggesting that it was probably collected after the generic name *Erythraea* Borkh. had been published in 1796, i.e., after the name *Gentiana pulchellum* had been published. The specimen at S has been annotated as the type of the name *G. pulchella*, but has not formally been designated the lectotype.

The lectotype at S comprises five plants mounted on one sheet. All of them are small, less than 1.3 cm from the base of the unbranched stem to the base of the solitary terminal flower. Such plants, which occur occasionally in several species of *Centaurium* in which the plants are usually taller and several- to many-flowered, are not ideally representative of any species, and their identification is often difficult or uncertain. Our study, therefore, has addressed the question as to whether the lectotype designated here actually does represent the species to which the name *Centaurium pulchellum* is now generally applied.

Two species of *Centaurium*, similar in morphology, are native to Finland: *C. littorale* (Turner) Gilmour and *C. pulchellum* (Melderis 1972). Neither *C. erythraea* Raf. nor *C. tenuiflorum* Hoffmanns. & Link, European species with which *C. pulchellum* has been confused elsewhere, is known from Finland, although the ranges of those species have expanded widely through naturalization in recent years. A basal rosette of leaves is usually well developed and persistent at flowering time in *C. littorale* and *C. erythraea*, whereas in *C. pulchellum* the rosette is less well developed, comprising fewer leaves, and is often withered or absent by flowering time. The plants in the Swartz collection, which were collected in flower, have distinct basal rosettes. In *C. pulchellum*, however, if floral initiation quickly follows germination, flowering can occur while the basal leaves are still present. This quite likely occurred with Swartz's specimens, which, as stated in the protologue (Swartz 1783), were collected near the northernmost limit of the range of the species, in a cold, high-altitude site that was inundated until relatively late in the season. Also, the basal and cauline leaves of the lectotype are elliptic-ovate, as is usual n *C. pulchellum*, whereas those of *C. littorale* are linear and proportionately narrower.

A more reliable character for distinguishing *Centaurium pulchellum* from *C. littorale* as well as from *C. erythraea* and *C. tenuiflorum* is that of the pedicels. In *C. pulchellum* there is a short but distinct pedicel between the bracts and the flower, whereas in *C. littorale* and the other species mentioned here the flowers are sessile or subsessile, borne immediately above the subtending bracts or nearly so (Pringle 2010). In Swartz's specimens and in his drawings there is in all cases a distinct pedicel, consistent in length with those of *C. pulchellum* (as the name is now applied) and long enough to eliminate *C. littorale, C. erythraea,* and *C. tenuiflorum* from consideration. Therefore, although in some respects Swartz's specimens depart from the usual morphology of *C. pulchellum*, we conclude that they are referable to the species currently known by that name. On the valid publication of the name *Centaurium pulchellum*, which has been attributed to several authors, see Pringle (2008).

Chironia gerardii F.W. Schmidt, Fl. Boëm. 1(2): 33. 1794 ["1793"], "*gerardi.*" TYPE: Not designated by Schmidt in the protologue.

Little of Schmidt's original material is extant. The name *Chironia gerardii* has been regarded as a heterotypic synonym of *Centaurium pulchellum, Erythraea pulchella*, or *E. ramosissima* (below) for over a century, following Grisebach (1838), and has not been used in recent literature or ever been associated with North American plants. Because the specific epithet *pulchellum* has priority, we have not investigated the potential typification of the name *C. gerardii.*

As Schmidt (1794) cited a work by late eighteenth-early nineteenth-century botanist Louis Gérard, indicating that the specific epithet commemorated him rather than the pre-Linnaean herbalist John Gerard, the correct orthography for the epithet is *gerardii.* (See Voss 1966 for a discussion of a comparable case.)

Erythraea ramosissima Pers., Syn. Pl. 1: 283. 1805, specific epithet superfluous, included *Chironia gerardii* F.W. Schmidt; non *Centaurium ramosissimum* (Vill.) Druce, Rep. Bot. Soc. Exch. Club Brit. Isles 4: 274. 1916 ("1915").

Centaurium candelabrum H. Lindb., Acta Soc. Sci. Fenn., Ser. B, Opera Biol. 1(2): 118. 1932. LECTOTYPE: *H. Lindberg* 2107, 12 May 1926, Morocco: Prope opp[idum] Mogador, in ripa fl. Oued Ksob (lectotype H, n.v., isotype S, n.v.). Designated by H. Väre, Phytotaxa 47: 28. 2012.

In addition, several names have been published at the ranks of subspecies, variety, and forma under *Centaurium pulchellum*. [*Centaurium pulchellum* var. *caspicum* (Fisch. ex Griseb.) R.R. Stewart was originally described as a species, but has been treated as a variety of *C. pulchellum* or reduced to complete synonymy in more recent works.] As all of these names were based on European, Asian, or, in one case, Australian plants, and none has been accepted by Melderis (1972) or Adams (1996) or been applied to North American plants, their typification has not been investigated in the present study. If varieties are accepted within *C. pulchellum*, the plants naturalized in North America can be designated *C. pulchellum* var. *pulchellum.*

Gentiana L. Sp. Pl. 1: 227. 1753.

DESIGNATED TYPE: *Gentiana lutea* L. Designated by A.S. Hitchcock & M.S. Green, Int. Bot. Congr. 1930, Nomencl. Proposals, Proposal 285, page 138. 1929.

Pneumonanthe Gled., Syst. Pl. Stamin. Situ 238. 1764. DESIGNATED TYPE: *Pneumonanthe vulgaris* F.W. Schmidt (= *Gentiana pneumonanthe* L.). Designated by J. Holub, Folia Geobot. Phytotax. 8: 161. 1973.

Cutlera Raf., Med. Repos., ser. 2, 5: 352. 1808, "*Cuttera*," nomen nudum; spelling corrected, name published pro syn, Fl. Tellur. 3: 22. 1837 ("1836"); *Xolemia* subgenus *Cutlera* Raf., Fl. Tellur. 3: 23. 1837 ("1836"). DESIGNATED TYPE: *Xolemia catesbaei* (Walter) Raf. (= *Gentiana catesbaei* Walter). Designated by J.S. Pringle, Sida 7: 176. 1977.

Although *Cutlera* Raf. and *Cuttera* Raf. have sometimes been treated as two different generic names, Rafinesque, in 1818 and 1837, in citing the earlier work by himself in which the name "*Cuttera*" had appeared and referring to the same species, corrected the orthography to "*Cutlera*," indicating that "*Cuttera*" had been a typographical error. In none of Rafinesque's works was this name, with or without the spelling error, validly published at the rank of genus.

Gentiana subgenus *Pneumonanthe* Raf., Med. Fl. 1: 208. 1828 (Jan; no indication of derivation from *Pneumonanthe* Gled., pro. gen.); *Gentiana* sect. *Pneumonanthe* (Raf.) Gaudin, Fl. Helv. 2: 269. 1828 (June; Raf. not cited); ORIGINAL TYPE: *Gentiana pneumonanthe* L. Int. Code Nomencl., 2011 ed., Art. 22.6.

Gentiana sect. *Cyane* Griseb. in Hook., Fl. Bor.-Amer. 2: 54. 1837. ORIGINAL TYPE: *Gentiana pneumonanthe* L. Based on *Cyana* Reneaulme, Specimen Hist. Pl. 69. 1611, a pre-Linnaean unitary name for *G. pneumonanthe*. This sectional name is therefore superfluous.

Xolemia Raf., Fl. Tellur. 3: 22. 1837 ("1836"). DESIGNATED TYPE: *Gentiana saponaria* L. Designated by J.S. Pringle, Sida 7: 176. 1977.

Although *Cutlera* Raf. and *Cuttera* Raf. have sometimes been treated as two different generic names, Rafinesque, in 1818 and 1837, in citing the earlier work by himself in which the name "*Cuttera*" had appeared and referring to the same species, corrected the orthography to "*Cutlera*," indicating that "*Cuttera*" had been a typographical error. In none of Rafinesque's works was this name, with or without the spelling error, validly published at the rank of genus.

Numerous additional generic names are usually considered to be heterotypically synonymous with *Gentiana* L. (listed in Pringle 1995), but, as the proposed segregates have generally been circumscribed, at least during the past six decades, none of them would include any of the New Jersey species. Especially notable among such names is *Dasystephana* Adans., Fam. Pl. 2: 502. 1763, which, prior to ca. 1950, was sometimes applied to species that included those native to New Jersey. That name, however, is typified by *Gentiana asclepiadea* L., the only species identified with *Dasystephana* in the protologue, with which none of the North American species would now be grouped. Another such name, although it was never widely used, is *Diploma* Raf., Fl. Tellur. 3: 19. 1837 ("1836"). That name was originally used by Rafinesque (1837) for a genus in which he included some of the species native to New Jersey, but when it was lectotypified

and reduced to subgeneric rank by Tsvelev (1993), the taxon to which it was applied was restricted to species with which those occurring in New Jersey would not now be grouped. Several additional names have been published for subdivisions of *Gentiana* (listed in Pringle 1978), but aside from those noted above, none of the taxa so named includes species occurring in New Jersey.

Gentiana andrewsii Griseb. in Hook., Fl. Bor.-Amer. 2: 55. 1837.

Dasystephana andrewsii (Griseb.) Small, Fl. S.E. U.S., ed. 1, 930, 1336. 1903; *Pneumonanthe andrewsii* (Griseb.) W.A. Weber, Phytologia 33: 105. 1976. LECTOTYPE: *R. Cleghorn s.n., s.d.*, Canada: Québec: Probably near Montréal or Sorel (K!). Designated by J.M. Gillett, Res. Branch, Canada Dept. Agric. Publ. 1180: 19. 1963.

New Jersey plants are:

Gentiana andrewsii var. *andrewsii*

Gentiana autumnalis L., Cat. Edwards' Nat. Hist. 11. 1776.

LECTOTYPE: Plate 255 in J. Edwards, Gleanings of Natural History. 1758! (icon; reproduced in C. Jarvis, Order out of Chaos 101. 2007!). Designated by J.S. Pringle, Brittonia 19: 2. 1967, following implied typification by M.L. Fernald, Rhodora 52: 68. 1950.

Gentiana porphyrio J.F. Gmel., Syst. Nat. 2: 462. 1791, at least sensu auctt.; *Hippion porphyrio* (J.F. Gmel.) F.W. Schmidt, Arch. Bot. (Leipzig) 1: 11. 1796; *Dasystephana porphyrio* (J.F. Gmel.) Small, Fl. S.E. U.S., ed. 1, 931, 1336. 1903. Based on *G. purpurea* Walter, Fl. Carol. 109. 1788, non L., Sp. Pl. 1: 283. 1753. TYPE: Not designated by Walter in the protologue.

The species now known as *Gentiana autumnalis* L. was called *G. porphyrio* J.F. Gmel. for many years. As noted by Fernald (1939), Gmelin (1791) had merely replaced the homonymous name *G. purpurea* Walter, non L., rather than having described a new species. No specimen representing Walter's concept of *G. purpurea* is known to exist. Walter's (1788) description of his *G. purpurea* was brief and vague, stating only that it had an unbranched stem, linear leaves, and an infundibuliform corolla, bright purple within. Gmelin added nothing further. He was not familiar with the species to which the name *G. porphyrio* would be applied by later authors. That association was established in 1838 by Grisebach, who, without discussion, placed the name *G. porphyrio* in the synonymy of *G. angustifolia* Michx. (see below).

With only a few possible exceptions, a folio at BM often called the Fraser/Walter herbarium contains the only extant specimens known to have been collected or studied by Walter (Ward 2006). It contains no specimens of the species now called *Gentiana autumnalis*, and it is doubtful whether Walter was acquainted with this species. Regardless of the species to which Walter applied the name *G. purpurea*, if that could be determined, the nomenclature of the Pine-barren Gentian would not be affected. The identity of the species illustrated in Edwards' *Gleanings of Natural History*, which typifies the older name *G. autumnalis* L., is unmistakable. It has, therefore, not been considered necessary to designate a neotype for the names *G. purpurea* Walter and *G. porphyrio* J.F. Gmel.

Gentiana angustifolia Michx., Fl. Bor.-Amer. 1: 177. 1803, illegitimate homonym, non Vill., Hist. Pl. Dauphiné 2: 526. 1787; *Diploma angustifolia* Raf., Fl. Tellur. 3: 27. 1837 ("1836"); *Ericala angustifolia* G. Don, Gen. Hist. 4: 190. 1837. (The names *Diploma angustifolia* Raf. and *Ericala angustifolia* G. Don are legitimate, but as both were based on an illegitimate name, *Gentiana angustifolia* Michx., Michaux's name is not cited in the authorship.) LECTOTYPE: *A. Michaux s.n., s.d.*, U.S.A.: in pratis Carolinae inferioris (lectotype P-Michx., specimen represented in IDC microfiche image Michaux Herbarium M40/9!; isolectotype P, catalogue number P00608814, image online!). Designated here.

Gentiana angustifolia [var.] *nana* J. McNab, Edinburgh New Philos. J. 19: 62. 1835. LECTOTYPE: *J. McNab s.n.*, Oct 1834, U.S.A.: New Jersey: Ocean Co.: Dry bank above Tuckerton Bay (holotype DBN, given number 320 by W.G. Dore, n.v., photocopy CAN; isolectotype PH!, image of PH specimen online!). Designated by E.C. Nelson and W.G. Dore, Notes Roy. Bot. Gard. Edinburgh 44: 347. 1987.

Gentiana stoneana Fernald, Rhodora 41: 555. 1939. ORIGINAL TYPE: *M.L. Fernald & B.H. Long 9611*, 13 Oct 1938, U.S.A.: Virginia: Nansemond Co.: north of Factory Hill (holotype GH! [photo Rhodora 41: pl. 579. 1939!], isotypes F!, MO!, NY!, PH!, US! [images of MO, NY, PH, and US specimens online!]). Designated in the protologue.

Gentiana catesbaei Walter, Fl. Carol. 109. 1788.

Pneumonanthe catesbaei (Walter) F.W. Schmidt, Arch. Bot. (Leipzig) 1: 10. 1796; *Cutlera catesbaei* (Walter) Raf., Amer. Monthly Mag. & Crit. Rev. 2: 176. 1818, "*Cuttera*," combination not validly published; *Xolemia catesbaei* (Raf.) Raf., Fl. Tellur. 3; 22. 1837 ("1836"), "*catesbei.*" LECTOTYPE: *T. Walter s.n., s.d.*, U.S.A.: South Carolina (specimen 50A in Fraser/Walter herbarium, BM, microfiche MO!, photos Rhodora 49: pl. 1076, figs. 1 and 2. 1947!, and Mus. Bull. S. Carolina Mus. Commission 5: 21. 1980!). Designated by D.B. Ward, J. Bot. Res. Inst. Texas 1: 414. 2007.

Gentiana elliottii Chapm., Fl. South. U.S. 356. 1860, non *G. elliottea* Raf., Med. Fl. 1: 212. 1828. Based on *G. catesbaei* Walter sensu Elliott, Sketch Bot. S. Carolina 1: 359. 1817, which appears to be correctly applied, so Chapman's name, whether or not considered homonymous, is superfluous. (The identity of *G. elliottea* Raf. [*Xolemia elliottea* (Raf.) Raf., Fl. Tellur. 3: 22. 1837 ("1836")] is uncertain, but it was probably based on plants of *G. saponaria.*)

Gentiana elliottii var. *parvifolia* Chapm., Fl. South. U.S. 356. 1860; *Dasystephana parvifolia* (Chapm.) Small, Fl. S.E. U.S., ed. 1, 930, 1336. 1903; *Pneumonanthe parvifolia* (Chapm.) Greene, Leafl. Bot. Observ. Crit. 1: 71. 1904; *Gentiana parvifolia* (Chapm.) Britt., Man. Fl. N. States, ed. 3, 733. 1907. LECTOTYPE: *A.W. Chapman 613a*, Nov 1831, U.S.A.: Georgia: Chatham Co.: Near Savannah on the road to Bonavista (US!). Designated here.

Gentiana catesbaei var. *nummulariifolia* Fernald, Rhodora 49: 175. 1947, "*nummulariaefolia.*" ORIGINAL TYPE: *M.L. Fernald & B.H. Long 9618*, 12 Oct 1938, U.S.A.: Virginia: Greensville Co.: about 1 mile northwest of Dahlia (holotype GH!, photo Rhodora 49: pl. 1078, figs. 3 and 4!). Designated in the protologue.

The name *Gentiana scaberrima* Kusn., Trudy Imp. S.-Peterburgsk. Bot. Sada 13: 59. 1893 may have been based on a mixture of *G. catesbaei* and *G. saponaria.* The specimens cited by Kusnezow (1893) may have been at B, in which case they would not now be extant, or at LE. The recognition of replicates of the collections elsewhere would be problematical, as some persons cited as collectors were probably instead the previous owners of specimens obtained through exchanges, as there are discrepancies between the provenances given for the specimens and the regions visited by those individuals. As earlier specific epithets exist for both *G. catesbaei* and *G. saponaria*, we have not investigated the typificaton of the name *G. scaberrima.*

Xolemia trachiloma Raf., Fl. Tellur. 3: 28. 1837 ("1836"), described from New Jersey, and its two varieties, var. *biflora* Raf., ibid., with no provenance given, and var. *major* Raf., ibid., from North Carolina, may have been based on specimens of the species now called *Gentiana catesbaei*, but, because of the brevity of the descriptions and the absence of any extant specimens or illustrations associated with these names, the identity of the plants so named remains uncertain.

Gentiana clausa Raf., Med. Fl. 1(41): 210. 1828.

Xolemia clausa (Raf.) Raf., Fl. Tellur. 3: 22. 1837 ("1836"); *Pneumonanthe clausa* (Raf.) Greene, Leafl. Bot. Observ. Crit. 1: 71. 1904; *Dasystephana clausa* (Raf.) A. Heller, Cat. N. Amer. Pl., ed. 3, 284. 1913. NEOTYPE: *J.S. Pringle 2732*, 11 Sept 2006, U.S.A.: New Hampshire: Coos Co.: Whitefield, west side of trail (former railroad bed) between trailhead parking lot and power line crossing, [in former railroad right-of-way through] Pondicherry Wildlife Refuge, ca. 345 m, ca. 44°21'N, 71°32'W [lat. incorrectly given as 44°26'on label], (neotype GH!, isoneotype HAM!). Designated here.

When Rafinesque (1828, 1841) described *Gentiana clausa* he neither cited specimens nor stated where he had seen herbarium specimens that he had identified as that species. He said that the species occurred in the "Taconick and Green mountains," ranges that, if correctly designated by Rafinesque, extend, respectively, from the Massachusetts-New York border north-northeast into southwestern Vermont, and in central Vermont from the southern border nearly to the northern border. Rafinesque did not visit the Green Mountains, and his closest approach to the Taconic range was the Hudson Valley, through which he traveled in 1806 as far as Saratoga Springs, New York, and "Ticonderoga in Vermont." (Ticonderoga and the site of Fort Ticonderoga are in New York, across the southern tip of Lake Champlain from Vermont. The boundary was the same in Rafinesque's time.) Fernald called attention to the distinctness of *G. clausa* from *G. andrewsii* in 1917, but he did not designate a type.

Rafinesque, apparently in preparation for a somewhat larger version of his *Manual of the Medical Botany of the United States* than was actually published, examined and annotated specimens of North American gentians in the herbarium of John Torrey, now at NY (Pringle 2003). Some of the names, or the specific epithets, in those annotations were subsequently published in works by Rafinesque; other names and epithets remained unpublished. Of chronological significance is a specimen of *Gentianopsis virgata* (Raf.) Holub that Rafinesque had annotated as *Gentiana virgata*, which had been collected by James McNab in 1834. As there is no indication that Rafinesque studied Torrey's specimens on more than one occasion, he probably did not see those specimens until after his *Medical Flora* (Rafinesque 1828, to be distinguished from his *Manual of the Medical Botany*), including his description of *G. clausa*, had been published. No specimen

annotated by Rafinesque as *Gentiana clausa* is among those from Torrey's herbarium at NY, nor is there any extant specimen of *G. clausa* from Torrey's herbarium that Rafinesque might have seen before or after 1828 without having annotated it.

As noted above, some specimens associated with Rafinesque are at PH. Among the historic specimens of *Gentiana*, only one, now in the general herbarium, was annotated by Rafinesque. This was annotated "*Gentiana saponaria* Rafinesque M fl [Medical Flora] presented by W. Hembel Esq." According to an annotation by Charles A. Pickering, this specimen had been in the herbarium of L.D. de Schweinitz under the name *G. saponaria*, and had been collected in New York by John Torrey. This specimen would still be identified as *G. saponaria* L., and there is no indication that Rafinesque ever identified it otherwise. The Barton Herbarium at PH contains a specimen of *G. clausa* collected by Frederick Pursh in 1807 at Rutland, Vermont, which is near the Green Mountains, but according to Alfred E. Schuyler, a noted scholar of Pennsylvania botanical history, there is no evidence that Rafinesque ever saw any specimens collected by Pursh. There are no specimens of *G. clausa* associated with Rafinesque at DWC. As no original material related to the publication of the name *Gentiana clausa* Raf. has been found, either by Stuckey (1971) or by us, a neotype is designated here.

Gentiana andrewsii [var.] β *intermedia* Kusn., Trudy S.-Peterburgsk. Obshch. Estestvoisp., Otd. Bot. 24(2): 24. 1894. LECTOTYPE: *G. Thurber s.n.*, Aug 1844, U.S.A.: Rhode Island: Providence Co.: Providence (GH!). Designated here.

The provenances of the specimens, the variation noted among them, and our identifications of replicates of some of the collections indicate that both *Gentiana clausa* and *G. andrewsii* var. *dakotica* A. Nels. were among the syntypes cited by Kusnezow (1894) for the name *Gentiana andrewsii* var. *intermedia*, but his emphasis on the foliaceous, broadly obovate calyx lobes indicates that this name was based primarily on *G. clausa*. Kusnezow had seen the syntypes at B and LE, but he did not say at which of those herbaria he had seen the respective specimens. The specimen collected by George Thurber was presumably seen at B, as specimens collected by Thurber are known to have been deposited at B but not at LE (Stafleu and Cowan 1986), in which case it would not likely be extant. A replicate at GH, identified as *G. clausa* by the first author, is part of the original material as defined by the *International Code of Nomenclature for Algae, Fungi, and Plants*, 2011 ed., Art. 9. Its designation as the.lectotype will prevent the currently used varietal epithet *dakotica* from being displaced by intermedia, which has not been used in that context since its publication.

Gentiana linearis Froel., Gentiana 37. 1796.

Ciminalis linearis (Froel.) Bercht. & C.Presl, Prir. Rostlin 1(Gentian.): 11. 1823; *Gentiana saponaria* [var.] β *linearis* (Froel.). Griseb. in Hook., Fl. Bor.-Amer. 2: 55. 1837; *Ericala linearis* (Froel.) G. Don, Gen. Hist. 4: 190. 1837, excl. descr.; *Gentiana catesbaei* [var.] β *linearis* (Froel.) Griseb., Gen. Sp. Gent. 287. 1838 ("1839"); *Pneumonanthe linearis* (Froel.) Greene, Leafl. Bot. Observ. Crit. 1: 71. 1904; *Dasystephana linearis* (Froel.) Britt. in Britt.& Brown, Ill. Fl. N. U.S., ed. 2, 3: 13. 1913. NEOTYPE: *A.F. Rhoads & T.A. Block s.n.*, 26 Aug 2010, U.S.A.: Pennsylvania: Carbon Co.: Albrightsville, 2.5 km SW, Hickory Run State Park, wetland in the headwaters of Panther Run, lat. 40.994507 long. -75.630660 (MOAR!). Designated here.

Froelich's (1796) own description of *Gentiana linearis* was based on, and supplemented by, a lengthier description of the species quoted from a manuscript by J.C.D. von Schreber. Schreber's description had been based on a specimen or specimens collected by J.D. Schöpf at "The Glades" in Pennsylvania. Schreber did not state where he had seen the specimen(s).

"The Glades," as a proper name for a place, and other names that include the word "Glade" or "Glades," have been used for several localities in Pennsylvania and adjacent states. These include localities near Philadelphia and Pittsburgh, Pennsylvania, in both of which areas Schöpf is known to have botanized (Kremers 1903). No specimens of *Gentiana* associated with Schöpf have been found at PH, where some specimens collected by him have been deposited, nor has a search of the databases of other herbaria reported to house specimens associated with Froelich, Schöpf, or Schreber indicated the existence of any specimens upon which the original description of *G. linearis* might have been based. A neotype is therefore designated in this paper. This specimen was collected in Pennsylvania, near "glades" that might have been visited by Schöpf.

Gentiana pseudopneumonanthe Schult. in Roem. & Schult, Syst. Veg. 6: 146. 1820, "*Pseudo-Pneumonanthe*." Based on *Gentiana pneumonanthe* L. sensu Michx., Fl. Bor.-Amer. 1:146. 1803 and Pursh, Fl. Amer. Sept. 1: 185. 1813 ("1814"), non quoad typum. LECTOTYPE: *A. Michaux s.n., s.d.*, Canada: ad sinum Hudsonis (P-Michx., specimen represented in IDC microfiche image Michaux Herbarium M40/4 !) Designated here.

Pneumonanthe media Raf., Fl. Tellur. 3: 19. 1837 ("1836"), specific epithet superfluous, based on *Gentiana pneumonanthe* L. sensu Michx. and *G. pseudopneumonanthe* Schult.

Diploma hudsonica Raf., Fl. Tellur. 3: 27. 1837 ("1836"), specific epithet superfluous, based on *Gentiana pneumonanthe* L. sensu North American botanists, i.e., sensu Michx. and Pursh, and therefore implying inclusion of the type of *G. pseudopneumonanthe* Schult.

Gentiana michauxii G. Don, Gen, Hist. 4: 194. 1837, superfluous name, based on *Gentiana pneumonanthe* L. sensu Michx. and therefore including type of *G. pseudopneumonanthe* Schult.

The four names above were all based on *Gentiana pneumonanthe* L., sensu Michaux (1803), but not as to the Linnaean type. Rafinesque (1837), within the same work, equated *Pneumonanthe media* with "*Gent. pneum.* N. Am. Botanists" and *Diploma hudsonica* with "*Gent. Pneumonanthe* Mx. non alis" [sic]. Michaux, who was familiar with the species now called *G. linearis* Froel., equated the North American plants with the European species *G. pneumonanthe*. Subsequent authors distinguished this North American species from the European, but acknowledged that the species to which they applied these new names was the species that had been called *G. pneumonanthe* by Michaux (1803). The pertinent specimen in Michaux's herbarium, cited above, is indeed *G. linearis*, confirming that any name based on *G. pneumonanthe* sensu Michaux was based on *G. linearis*.

Gentiana saponaria [var.] β *froelichii* Torr. & A. Gray in A. Gray, Man., ed 1, 360. 1848. Based on *G. linearis* Froel. and therefore having the same neotype.

Gentiana saponaria L., Sp. Pl. 1:228. 1753.

Pneumonanthe saponaria (L.) F.W. Schmidt, Arch. Bot. (Leipzig) 1: 10. 1796; *Cutlera saponaria* (L.) Raf., Med. Repos., ser. 2, 5: 352. 1808, "*Cuttera*," combination not validly published; *Ciminalis saponaria* (L.) Bercht. & J. Presl, Prir. Rostlin 1 (Gentian.): 11. 1823; *Dasystephana saponaria* (L.) Small, Fl. S.E. U.S., ed. 1, 930. 1336. 1903. LECTOTYPE: P. Kalm s.n., 1749, U.S.A.: "Virginia" [probably actually New Jersey or Pennsylvania] (LINN 328.8 [image online!, photos BM!, DAO!, GH!]). Designated by J.S. Pringle, Brittonia 19: 2. 1967.

Gentiana fimbriata Vahl, Symb. Bot. 3: 46. 1794, illegitimate homonym, non Vitman, Summa Pl. 2: 117. 1788.

Gentiana puberula Michx., Fl. Bor.-Amer. 1: 176. 1803; *Geniana saponaria* [var.] β *puberula* (Michx.) Torr. & A. Gray in A. Gray, Man. 360. 1848; *Dasystephana puberula* (Michx.) Small, Fl. S.E. U.S., ed. 1, 930, 1336. 1903; *Pneumonanthe puberula* (Michx.) Greene, Leafl. Bot. Observ. Crit. 1: 71. 1904, as to type only, not sensu auctt. after Michaux. LECTOTYPE: *A. Michaux s.n.*, autumn 1795, U.S.A.: Illinois: Massac Co. (present-day designation): ad confluentem fluviorum Ohio et Mississipi [sic], prope propugnaculum Cheroquis (holotype P, photos GH!, Rhodora 68: 210. 1966!, IDC microfiche image Michaux Herbarium 40/9 !). Designated by J.S. Pringle, Rhodora 68: 209. 1966.

The name *Gentiana puberula* is typified by a specimen of the species now known as *Gentiana saponaria* L. Michaux's collection from Fort Cheroquis was the only one cited by him, and the data on the specimen cited above, and on no other specimen in Michaux's herbarium, agree with the description and data given for *G. puberula* by Michaux. Subsequent authors misapplied the name *G. puberula* to the species now known as *G. puberulenta* J.S. Pringle, which does not occur in New Jersey (Pringle 1966).

Gentiana elliottii var.? [sic] *latifolia* Chapm., Fl. South. U.S. 356. 1860; *Dasystephana latifolia* (Chapm.) Small, Fl. S.E. US., ed. 1, 930, 1336. 1903; *Pneumonanthe latifolia* (Chapm.) Greene, Leafl. Bot. Observ. Crit. 1:71. 1904. TYPE: Not designated by Chapman in the protologue.

Chapman (1860), who appears to have had doubts as to whether this variant was worthy of taxonomic recognition, did not cite any specimens in association with this name. He reported it only from "Middle Florida." The only collection from Florida identified as *Gentiana elliottii* var. *latifolia* by Chapman found in this study is *A.W. Chapman s.n.*, Oct 1897, U.S.A: Florida: Gadsden Co.: Aspalaga (MO!, NY!, US!). These specimens, having been collected long after the name had been published, do not constitute part of Chapman's original material. These specimens have been identified by the first author as *G. saponaria*.

Chapman's (1860) description of var. *latifolia* serves mainly to distinguish it from the other varieties he recognized within *Gentiana elliottii*, which would now be included in *G. catesbaei*, and does not suffice to distinguish it from typical *G. saponaria*. *Gentiana saponaria* is notably variable in leaf proportions and other characters, and variation within the species is not sufficiently well correlated with geographic distribution to justify the recognition of infraspecific taxa. Therefore no neotype is designated in this study.

Dasystephana cherokeensis W.P. Lemmon, Bartonia 17: 4. 1935; *Gentiana cherokeensis* (W.P. Lemmon) Fernald, Rhodora 41: 487. 1939. ORIGINAL TYPE: *W.P. Lemmon s.n.*, October 1935, U.S.A.: Georgia: Cobb Co.: north end of Black Jack Mountain (holotype PH!, isotypes GH!, US!). Designated in the protologue.

Gentiana saponaria var. *allegheniensis* Jennings, Castanea 12: 57. 1947. ORIGINAL TYPE: *O.E. Jennings s.n.*, 13 Oct 1946, U.S.A.: Pennsylvania: Fayette Co.: Markleysburg, in sphagnum-cranberry glade about 2400 ft altitude (holotype CM!). Designated in the protologue.

Several "species" described by C.S. Rafinesque from Kentucky and adjacent states may have been based on specimens of *G. saponaria* (see list in Pringle 1967). Because of the brevity of the descriptions, the absence of specimens so identified by Rafinesque, and the absence of any extant specimens of *Gentiana* collected by Rafinesque in, or likely to have been seen by Rafinesque from, Kentucky, Tennessee, or the southern portions of states north of the Ohio River, their identity remains uncertain.

Gentiana villosa L., Sp. Pl. 1:228. 1753.
Pneumonanthe villosa (L.) F.W. Schmidt, Arch. Bot. (Leipzig) 1: 10. 1796; *Dasystephana villosa* (L.) Small, Fl. S.E. U.S., ed. 1, 931, 1336. 1903. LECTOTYPE: *J. Clayton 605, s.d.*, U.S.A.: Virginia (BM [image online!]). Designated by J.L. Reveal & C.E. Jarvis, Taxon 58: 979. 2009.

Gentiana ochroleuca Froel., Gentiana 35. 1796; *Cutlera ochroleuca* (Froel.) Raf., Med. Repos., ser. 2, 5: 352. 1808, "*Cuttera*," combination not validly published; *Ciminalis ochroleuca* (Froel.) Bercht. & J. Presl, Prir. Rostlin 1 (Gentian.): 11. 1823; *Pneumonanthe ochroleuca* (Froel.) G. Don, Gen. Hist. 4: 195. 1837. NEOTYPE: *N.L. Britton s.n.*, 23 Sept 1881, U.S.A.: New Jersey: Cumberland Co.: Near Bridgeton (CHRB, acc. no. 0003339). Designated here.

Froelich, who did not visit North America himself, did not specify the provenance or the collector of the specimen or specimens upon which he based his description of *Gentiana ochroleuca*. The fate of Froelich's own herbarium is not known. Few specimens definitely associated with Froelich are known to exist, and those are generally not of North American origin. The description of the species thus named is sufficiently detailed that its identity has not been questioned.

Gentiana incarnata Sims, Bot. Mag. 43: pl. 1856. 1816; *Pneumonanthe incarnata* (Sims) G. Don, Gen. Hist. 4: 195. 1837. LECTOTYPE: Bot. Mag. Pl. 1856 [icon]!. Designated here.

Gentiana intermedia Sims, Bot. Mag. 49: pl. 2303. 1822; *Pneumonanthe intermedia* (Sims) G. Don, Gen. Hist. 4: 195. 1837. LECTOTYPE: Bot. Mag. Pl. 2303 [icon]!. Designated here.

The two names above were based on plants that were distinguished from "*Gentiana ochroleuca*" (= *G. villosa*) primarily on the basis of corolla color. *Gentiana villosa* varies in the amount of blue or violet pigment in the corolla, and nothing about the descriptions or the illustrations indicates that the plants to which these names were applied should not be included in *G. villosa*. The illustrations and descriptions were based on fresh material from cultivated plants, that of *G. incarnata* from plants from "Carolina," and that of *G. intermedia* from plants from "North America," assumed to be from Virginia, perhaps

indirectly via subsequent propagation in England. Sims did not state whether herbarium specimens were prepared from the artist's material. Specimens associated with Sims, when extant, are generally at K, but no such specimens of North American gentians were found there by the first author. Considering the unlikelihood that any specimens used in the preparation of these descriptions are extant, and because the identity of the plants illustrated has been considered unequivocal in this and earlier studies, it seems best to typify these two names by the illustrations cited above.

Gentiana heterophylla Raf., Med. Fl. 1: 211. 1828; *Xolemia heterophylla* (Raf.) Raf., Fl. Tellur. 3; 22. 1837 ("1836"). TYPE: Not designated by Rafinesque in the protologue; identified ex char.

Grisebach (1845) cited the epithets *incarnata*, *intermedia*, and *heterophylla* under *Gentiana ochroleuca*, but with asterisks rather than with the Greek letters that he and other authors in the Candolles' *Prodromus* regularly used for designating varieties. He suspected that the plants to which these epithets had been applied were interspecific hybrids rather than variants of *G. ochroleuca* (*G. villosa*), but from the illustrations and original descriptions this seems unlikely. For that reason, and because of the departure from the format used for varieties, we consider these names to have been published sine ord., rather than being validly published varietal combinations.

Gentiana serpentaria Raf., Ann. Nat. 13. 1820; *Xolemia serpentaria* (Raf.) Raf., Fl. Tellur. 3; 22. 1837 ("1836"). TYPE: Not designated by Rafinesque in the protologue; identified ex char.

The paucity of specimens directly associated with names published by Rafinesque has been noted in the introduction to this paper. As neither of the names *Gentiana heterophylla* and *G. serpentaria* is now accepted for any taxon, and neither specific epithet would have priority over villosa, we have not designated neotypes.

Some other names published by Rafinesque (1841) may have been based on plants of *G. villosa*, but, because of the brevity of the descriptions and the absence of illustrations or specimens, the identity of the plants so named remains uncertain (Pringle 1967).

Dasystephana deloachii W.P. Lemmon, Bartonia 19: 18. 1938; *Gentiana deloachii* (W.P. Lemmon) Shinners, Sida 1: 107. 1962. ORIGINAL TYPE: *W.P. Lemmon s.n.*, 25 Oct 1936, U.S.A.: Georgia: Effingham Co.: near Clyo (holotype PH!). Designated in the protologue.

Gentianella Moench, Methodus: 482. 1794, nom. cons.
ORIGINAL TYPE: *Gentianella tetrandra* Moench (= *Gentianella campestris* (L.) Börner). Only species included in the genus by Moench in the protologue.

Amarella Gilib., Fl. Lit. Inch. 1: 36. 1782 ("1781"), nom. rej. DESIGNATED TYPE: *Amarella quinquefida* Gilib., specific name not validly published (= *Gentianella amarella* (L.) Börner). Designated by S. Rauschert, Taxon 25: 192. 1976.

Eyrythalia Borkh., Arch. Bot. (Leipzig) 1: 28. 1796, superfluous name, included *Gentianella* Moench.

Aloitis Raf., Fl. Tellur. 3: 21. 1837 ("1836"). DESIGNATED TYPE: *Aloitis quinquefolia* (L.) Raf., "*5flora*" (= *Gentianella quinquefolia* (L.) Small). Designated by S. Garg, *Gentianaceae* NW Himalaya 137. 1987.

Gentiana subgenus *Amarelloides* Torr. & A. Gray in A. Gray, Man., ed. 1, 358. 1848. ORIGINAL TYPE: *Gentiana amarella* L. (= *Gentianella amarella* (L.) Börner). Int. Code Nomencl., 2011 ed., Art. 22.6.

Several additional generic names now usually considered to be heterotypically synonymous with *Gentianella* Moench have been applied to Asian, Australian, and South American species (listed in Pringle 1995), but none is typified by a North American species, nor would any North American species likely be considered referable to any of those segregates. Likewise, several subgeneric and sectional names (listed in Pringle 1978, 1995) have been used for species in other parts of the world, but would not be considered applicable to North American species. Names published by Gaudin (1828) for subdivisions of *Gentiana* now referable to *Gentianella* or *Gentianopsis* are listed in Pringle (1978).

Gentianella quinquefolia (L.) Small, Fl. S.E. U.S., ed. 1: 929, 1336. 1903.

Gentiana quinquefolia L., Sp. Pl. 1: 230. 1753; *Hippion quinquefolium* (L.) F.W. Schmidt, Arch. Bot. (Leipzig) 1: 11. 1796; *Aloitis quinquefolia* (L.) Raf., Fl. Tellur. 3: 22. 1837 "1836"), "*quinqueflora*." LECTOTYPE: *P. Kalm s.n.*,1749, U.S.A.: Pennsylvania (LINN 328.31 [image online!, photos A!, DAO!, MO!]). Designated by J.M. Gillett, Ann. Missouri Bot. Gard. 44: 243. 1957. *Gentiana quinqueflora* auctt., orthographic error.

Gentiana amarelloides Michx., Fl. Bor.-Amer. 1: 175. 1803; *Gentianella quinquefolia* var. *amarelloides* (Michx.) Britt., Mem. Torrey Bot. Club 5: 260. 1894; *Amarella amarelloides* (Michx.) Greene, Leafl. Bot. Observ. Crit. 1: 53. 1904. LECTOTYPE: *A. Michaux s.n., s.d.,* U.S.A.: Kentucky (holotype P-Michx., photo MO!, IDC microfiche image Michaux Herbarium 40/6 !). Designated by J.M. Gillett, Ann. Missouri Bot. Gard. 44: 244. 1957.

New Jersey plants are:

Gentianella quinquefolia* subsp. *quinquefolia

Aloitis parviflora Raf., Fl,. Tellur. 3: 21. 1837 ("1836"); *Gentiana quiunquefolia* [var.] β *parviflora* (Raf.) Raf. ex Griseb, in DC., Prodr. 9: 100. 1845, "*quinqueflora*," attrib. to Raf. TYPE: Not designated by Rafinesque in the protologue; identification follows Gillett (1959).

This name is not accepted for any taxon in this or other studies by the present authors, and, as no application of the epithet is foreseen, it has not been considered necessary to designate a neotype here.

Gentianopsis Ma, Acta Phytotax. Sin. 1: 7. 1951.

Gentiana subgenus *Gentianopsis* (Ma) Toyok., Hokuriku J. Bot. 6: 33. 1957; *Gentiana* sect. *Gentianopsis* (Ma) Satake, Nat. Sci. Mus. 24: 141. 1957, combination not validly published (basionym not specified, required information not provided). ORIGINAL TYPE: *Gentianopsis barbata* (Froel.) Ma. Designated in the protologue.

Gentianella Borkh., Arch. Bot. (Leipzig) 1: 29. 1796, illegitimate homonym, non Moench, Methodus 482. 1794.

Gentiana **** *Crossopetalae* [sic] Froel., Gentiana 109. 1796, sine ord.; *Gentiana* sect. *Crossopetalae* (Froel.) Griseb. in Hook., Fl. Bor.-Amer. 2: 64. 1837. TYPE: Not designated by Froelich in the protologue.

The citation of authorship here follows the *International Code of Nomenclature for Algae, Fungi, and Plants*, 2011 ed., Art. 37.3, Ex. 4. *Gentiana crinita* Froel. (= *Gentianopsis crinita* (Froel.) Ma), which had been included in the unranked taxon by Froelich (1796), was the only species specifically mentioned by Grisebach in 1837 as being in sect. *Crossopetalae*.

Denckea Raf., Med. Repos., ser. 2, 5: 352. 1808, nomen nudum.

Crossopetalum Roth, Enum. Pl. Phaen. 1: 515. 1827, illegitimate homonym, non P. Browne, Civ. Nat. Hist. Jamaica 145. 1756.

Gentiana subgenus *Eublephis* Raf., Med. Fl. 1: 208. 1828; *Gentianella* subgenus *Eublephis* (Raf.) J.M. Gillett, Ann. Missouri Bot. Gard. 44: 210. 1957. ORIGINAL TYPE: *Gentiana crinita* Froel. Only species cited by Rafinesque in the protologue.

Anthopogon Raf., Fl. Tellur. 3: 25. 1837 ("1836") (attrib. to Necker, who had used the epithet as a unitary specific name), illegitimate homonym, non Nutt., Gen. N. Amer. Pl. 1: 81. 1818.

Gentianopsis crinita (Froel.) Ma, Acta Phytotax. Sin. 1: 15. 1951.

Gentiana crinita Froel., Gentiana 112. 1796; *Denckea crinita* (Froel.) Raf., Med. Repos., ser. 2, 5: 352. 1808, combination not validly published; *Gentianella crinita* (Froel.) Bercht. & J. Presl, Prir. Rostlin 1 (Gentian.): 21. 1823; NEOTYPE: *P. Kalm s.n.*, 1749, U.S.A.: Pennsylvania (LINN 328.38 [image online!]). Designated by J.S. Pringle, Michigan Bot. 46: 122. 2008.

Gentiana fimbriata Andrews, Bot. Repos. 8: pl. 509. 1808, illegitimate homonym, non Vitman, Summa Pl. 2: 117. 1788.

Anthopogon incarnatum Raf., New Fl. 4: 90. 1836. TYPE: Not designated by Rafinesque in the protologue; identified ex char.

Anthopogon brevifolium Raf., New Fl. 4: 91. 1836. TYPE: Not designated by Rafinesque in the protologue; identified ex char.

These last two names were based on plants from the Allegheny Mountains of Pennsylvania. No specimens so identified by Rafinesque, nor any specimens from Pennsylvania compatible with the descriptions and likely to have been seen by Rafinesque, are known to exist. As no requirement for the epithets is foreseen, it has not been considered necessary to designate neotypes.

Obolaria L., Sp. Pl. 2: 632. 1753.

ORIGINAL TYPE: *Obolaria virginica* L. Only species included in the genus by Linnaeus in the protologue (genus monospecific).

Shultzia Raf., Med. Repos., ser. 2, 5: 356. 1808, nom. rej., non *Schulzia* Spreng., Neue Schriften Naturf. Ges. Halle 2(1): 30. 1815, nom. cons. ORIGINAL TYPE: *Shultzia obolarioides* Raf. (= *Obolaria virginica* L.). Only species included in the genus by Rafinesque in the protologue

Obolaria virginica L., Sp. Pl. 632. 1753.

Shultzia virginica (L.) Kuntze, Revis. Gen. Pl. 2: 430. 1891. LECTOTYPE: *J. Clayton 286, s.d.*, U.S.A.: Virginia (BM [image online!]). Designated by J.M. Gillett, Rhodora 61: 61. 1959.

Shultzia obolarioides Raf., Med. Repos., ser. 2, 5: 356. 1808. TYPE: U.S.A.: Pennsylvania, Berks Co., *B. Shultz s.n., s.d.* (formerly in Rafinesque's herbarium, probably not extant).

Sabatia Adans., Fam. Pl. 2: 503. 1763.

ORIGINAL TYPE: *Sabatia dodecandra* (L.) Britton, Stearns, & Poggenb. Only species associated with *Sabatia* by Adanson in the protologue; see Blake (1915) and Wilbur (1989). *Sabbatia* auctt., orthographic variant.

Pleienta Raf., Fl. Tellur. 3: 30. 1837 ("1836"), superfluous name, included type of *Sabatia* Adans.

Neurola Raf., New Fl. 4: 92. 1838. ORIGINAL TYPE: *Neurola arkanzica* Raf. (specific name not validly published; = *Sabatia campestris* Nutt.). Only species included in the genus by Rafinesque in the protologue

Sabatia angularis (L.) Pursh, Fl. Amer. Sept. 1: 137. 1813 ("1814"), "*Sabbatia.*"

Chironia angularis L. Sp. Pl. 1: 190. 1753. LECTOTYPE: *P. Kalm s.n.*, 1749, U.S.A.: Virginia (LINN 252.5 [image online!]). Designated by R.L. Wilbur, Rhodora 57: 20. 1955.

Sabatia campanulata (L.) Torr., Fl. N. Middle United States 1: 217. 1824, "*Sabbatia.*"

Chironia campanulata L., Sp. Pl. 1: 190. 1753. LECTOTYPE: *P. Kalm s.n.*, 1749. "Canada" [probably actually U.S.A.: New Jersey or Pennsylvania] (LINN 252.4 [image online!]). Designated by S.F. Blake, Rhodora 17: 52. 1915.

Chironia gracilis Michx., Fl. Bor.-Amer. 1: 146. 1803; *Sabatia gracilis* (Michx.) Salisb., Parad. Lond. t. 32. 1806, "*Sabbatia*"; *Sabatia campanulata* var. *gracilis* (Michx.) Fernald , Rhodora 39: 444. 1937. LECTOTYPE: *A. Michaux s.n., s.d.*, U.S.A.: in Carolina inferiore (P-Michx., specimen represented in IDC microfiche image Michaux Herbarium M35/9!). Designated here.

Sabatia tracyi Gand., Bull. Soc. Bot. France 65: 61. 1918, "*Sabbatia.*" ORIGINAL TYPE: *S.M. Tracy 6468*, 22 June 1899, U.S.A.: Mississippi: Harrison Co.: Biloxi (holotype LY, isotypes GH!, NY, US [image of US specimen online!]) Designated in the protologue.

Sabatia difformis (L.) Druce, Rep. Bot. Soc. Exch. Club Brit. Isles 3: 423. 1914.

Swertia difformis L. Sp. Pl. 1: 226. 1753. LECTOTYPE: *J. Clayton 171, s.d.*, U.S.A.: Virgina (BM [image online!]). Designated by S.F. Blake, Rhodora 17: 50. 1915.

Chironia lanceolata Walter, Fl. Carol. 95. 1788; *Sabatia lanceolata* (Walter) Raf., Fl. Tellur. 3: 30. 1837 ("1836"), "*Sabbatia lanceol.*"; *S. lanceolata* (Walter) Torr. & A. Gray in A. Gray, Manual 356. 1848, "*Sabbatia*," superfluous combination if Rafinesque's is accepted (following Wilbur 1955) as having been based on *C. lanceolata* Walter. TYPE: Not designated by Walter in the protologue.

The complex history of these names has been reviewed by Wilbur (1955). Although Wilbur did not designate a lectotype, he noted that two specimens of *Sabatia* in the Fraser/Walter folio herbarium at BM corresponded closely to Walter's description of *Chironia lanceolata*. He identified those specimens as *S. difformis* and included the name *C. lanceolata* Walter and its nomenclatural synonyms in the synonymy of *Sabatia difformis* (L.) Druce. As the epithet *lanceolata* would not be required for any currently accepted taxon in *Sabatia*, we have not designated a lectotype.

Chironia cymosa Lam., Tabl. Encyc. 1: 479. 1793, illegitimate homonym, non N.L. Burm., Fl. Indica 5. 1768; *Sabatia cymosa* G. Don, Gen. Hist. 4: 207. 1838, "*Sabbatia* ," based on *Chironia cymosa* Lam., but not as to plants described by Don, which were identified by Wilbur (1955) as *Sabatia quadrangula* Wilbur. (Whether *S. cymosa* Raf., Fl. Tellur. 3: 30. 1837 ("1836"), nomen nudum, was based on *C. cymosa* Lam. is uncertain.)

Chironia paniculata Michx., Fl. Bor.-Amer. 1: 146. 1803; *Sabatia paniculata* (Michx.) Pursh, Fl. Amer. Sept. 1: 138. 1813 ("1814"), "*Sabbatia*." LECTOTYPE: *A. Michaux s.n., s.d.*, U.S.A.: Carolina (P-Michx., specimen represented in IDC microfiche Michaux Herbarium M35/6 !). Designated here.

Sabatia corymbosa Baldw. ex Ell., Sketch Bot. S. Carolina 1: 283. 1817, "*Sabbatia*," specific epithet superfluous, included *Chironia lanceolata* Walter.

Sabatia corymbosa [var.] β *angustifolia* Ell., Sketch Bot. S. Carolina 1: 283. 1817, "*Sabbatia*." TYPE: Not designated by Elliott in the protologue.

The inclusion of this name in the synonymy of *Sabatia difformis* (L.) Druce follows Wilbur (1955). The status of this name is ambiguous, because Elliott himself expressed uncertainty as to which of the varieties of *S. corymbosa* that he recognized was equivalent to *Chironia lanceolata* Walter. Whichever way this name might be interpreted, neither it nor its varietal epithet would be required for any currently accepted taxon.

Sabatia dodecandra (L.) Britton, Sterns & Poggenb., Prelim. Cat. 36. 1888, "*Sabbatia*."
Chironia dodecandra L., Sp. Pl. 190. 1753; *Chlora dodecandra* (L.) L., Syst. Nat., ed. 12, 2: 267. 1767. LECTOTYPE: *J. Clayton 120, s.d.*, U.S.A.: Virginia (BM [image online!]). Designated by R.L. Wilbur, Rhodora 57: 56. 1955.

Chironia chloroides Michx., Fl. Bor.-Amer. 1: 147. 1803, specific epithet superfluous, included *Chlora dodecandra* (L.) L. *Sabatia chloroides* (Michx.) Pursh, Fl. Amer. Sept. 1: 138. 1813 ("1814"), "*Sabbatia*.,"

Sabatia stellaris Pursh, Fl. Amer. Sept. 1: 137. 1813 ("1814"), "*Sabbatia*."
Chironia stellaris (Pursh) Eaton, Man., ed. 2, 204. 1818. LECTOTYPE: Probably collected by *F. Pursh*, U.S.A.: New Jersey, sheet 1 of specimen numbered 1439 in PH-Muhl., numbered 41 by Muhlenberg in herb. and in a manuscript (copy of relevant portion attached to herbarium sheet), also numbered 329 by Pursh; PH accession number 0109108. Designated here.

Pursh (1813) did not cite any herbarium specimen of *Sabatia stellaris* or state where he had seen any such specimens. He said that *S. stellaris* grew in salt marshes in New

York and New Jersey, but mentioned no specific localities. His mention of the salt-marsh habitat indicates that he applied the name *S. stellaris* to the halophytic species with which that name is now associated (Bicknell 1915; Fernald 1916, 1932).

In the Muhlenberg herbarium at PH there is a collection of the species now known as *Sabatia stellaris* Pursh, occupying two sheets, jointly numbered 1439 and enclosed in a folder bearing the same number. Affixed to one of these sheets is a copy of a portion of a manuscript flora by G.H.E. Muhlenberg, with the following wording in Muhlenberg's handwriting:

> *Chironia stellaris* Pursh n. 41 Muhl. ms.
> *Chironia stellaris* 329 N. Jersey - Pursh's label.

This is followed by a description of the species by Muhlenberg. Pursh's number 329 appears on both herbarium sheets. Sheet 1 also bears the following annotation by former PH curator James A. Mears:

> Muhl. had this from Pursh, poss. authentic *Sabbatia stellaris* Pursh JAM 9/83

These labels and annotations indicate that this is a collection of *Sabatia* to which Pursh himself had applied the specific epithet *stellaris*. He had done so before he adopted the name *Sabbatia* [sic] for the genus, which name he used when he described the species in 1813. It may not have been the only material of that species that Pursh saw prior to 1813, but it was evidently part of his original material, and is probably the only extant component unequivocally associated with the specific epithet *stellaris*. It is, therefore, appropriate for designation as the lectotype.

Chironia amoena Raf., Med. Repos., ser. 2, 5: 359. 1808, "*Chironea*," illegitimate homonym, non Salisb., Prodr. Stirp. Chap. Allerton 137. 1796. *Sabatia amoena* G. Don, Gen. Hist. 4: 207. 1838, "*Sabbatia*"; *Sabatia campanulata* var. *amoena* (G. Don) Monachino, Torreya 41: 99. 1941, "*Sabbatia*." (These two names were based on *Chironia amoena* Raf., although, as that name was illegitimate, the combinations should be attributed to G. Don and to (G. Don) Monachino, respectively, with Rafinesque's name not cited in the authorship). TYPE: Not designated by Rafinesque, Don, Fernald, or Monachino; identification here follows Fernald (1932) and Wilbur (1955).

Sabatia maritima Raf., Med. Fl. 2: 77. 1830, "*Sabbatia*." TYPE: Not designated by Rafinesque in the protologue; identification here follows Fernald (1932) and Wilbur (1955).

Sabatia nana Featherm., Rep. Bot. Surv. S. & Central Louisiana 71-72: 102. 1871, "*Sabbatia*." TYPE: Not designated by Featherman in the protologue; identification here follows Wilbur (1955).

Few specimens representing either Rafinesque's or Featherman's original material are extant, and none have been located that could be associated with any of the three names above. As these names were not accepted in Wilbur's (1955) taxonomic revision of *Sabatia* and have not been accepted in works by later authors, we have not designated neotypes.

Eustoma maculatum Benth., Pl. Hartw. 292. 1848; *Sabatia maculata* (Benth.) A.Gray, Proc. Amer. Acad. Arts 22: 438. 1887, "*Sabbatia*." ORIGINAL TYPE: *Hartweg 1615*, 1835, Mexico: Jalisco: Lagos de Moreno (K [image online!]). Designated in the protologue.

Sabatia palmeri A. Gray, Proc. Amer. Acad. Arts 22: 438. 1887, "*Sabbatia*." ORIGINAL TYPE: *E.J. Palmer 668*, Oct 1886, Mexico: Jalisco: Rio Blanco (GH!). Designated in the protologue.

Sabatia simulata Britton, Bull. N.Y. Bot. Gard. 3: 448. 1905, "*Sabbatia*." ORIGINAL TYPE: *N.L. Britton 58*, 7-8 April 1904, Bahamas: New Providence, near South Beach (NY [image online!]). Designated in the protologue.

Sabatia purpusii Brandegee, Univ. Calif. Publ. Bot. 4: 275. 1912, "*Sabbatia*." ORIGINAL TYPE: *C.A. Purpus 5345*, July 1911, MEXICO: San Luis Potosi: Minas de San Rafael, Mexico (holotype UC, isotype NY [images of both specimens online!]). Designated in the protologue.

Schenkia Griseb., Bonplandia (Hannover) 1: 226. 1853.
ORIGINAL TYPE: *Schenkia sebaeoides* Griseb. Only species included in the genus by Grisebach in the protologue.

Erythraea sect. *Spicaria* Griseb., Gen. Sp. Gent. 147. 1839; *Centaurium* sect. *Spicaria* (Griseb.) Ronniger, Mitt. Naturwiss. Vereines Steiermark 52: 321. 1916. DESIGNATED TYPE: *Erythraea spicata* (L.) Pers., based on *Gentiana spicata* L. Designated here.

Schenkia spicata (L.) G. Mans., Taxon 53: 726. 2004.
Gentiana spicata L., Sp. Pl.: 230. 1753; *Hippion spicatum* (L.) F.W. Schmidt, Arch. Bot. (Leipzig) 1: 11. 1796; *Chironia spicata* (L.) Willd., Sp. Pl. 1(1): 1069. 1797; *Erythraea spicata* (L.) Pers., Syn. Pl. 1: 283. 1805; *Centaurodes spicatum* (L.) Kuntze, Revis. Gen. Pl. 2: 426. 1891; *Centaurium spicatum* (L.) Fritsch, Mitt. Naturwiss. Vereins Univ. Wien 5: 97. 1907. LECTOTYPE: *C. Bauhin s.n., s.d.*, "In montibus Euganensis Monspelii" (UPS [image online!]). Designated by G. Mansion, Taxon 53: 726. 2004.

Some local European variants previously treated as varieties of *Schenkia spicata* (as *Centaurium*) were not considered appropriate for taxonomic recognition by Mansion (2004). As it is doubtful that any North American plants would have been referable to those varieties, their names are not included in the synonymy given here.

Erythraea pickeringii Oakes, Mag. Hort. Bot. 7: 179. 1841. ORIGINAL TYPE: *W. Oakes s.n.*, Sept 1829, U.S.A.: Massachusetts: Nantucket Co.: sea shore, Nantucket (holotype GH!, isotype GH!). Designated in the protologue.

Literature Cited

Adams, L. G. 1996. Gentianaceae. pp 72-104. In *Flora of Australia*, Vol. 28, A. Wilson (ed.). CSIRO Australia, Melbourne.

Bicknell, E. P. 1915. The ferns and flowering plants of Nantucket-XIV. *Bulletin of the Torrey Botanical Club* 42:27-47.

Blake, S. F. 1915. Notes on the genus *Sabatia*. *Rhodora* 18:50-57.

Chapman, A. W. 1860. *Flora of the Southern United States*. Ivison, Phinney & Co., New York, NY. 621 pp.

FERNALD, M. L. 1916. The genus *Sabatia* in New England. *Rhodora* 18:145-152, pl. 121.
FERNALD, M. L. 1917. *Gentiana clausa* a valid species. *Rhodora* 19:147-149.
FERNALD, M. L. 1932. Some genera and species of Rafinesque. *Rhodora* 34: 21-28.
FERNALD, M. L.. 1939. Last survivors in the flora of Tidewater Virginia. *Rhodora* 41: 465-504, 529-555, 564-574, pls. 570-583.
FROELICH, J. A. 1796. *De* Gentiana *Libellus Sistems Specierum Cognitarum Descriptiones cum Observationibus*. W. Walther, Erlangen.
GAUDIN, J. F. A. P. 1828. *Flora Helvetica*, Vol. 2. Orellii, Fuesslini et Sociorum, Turici (Zurich).
GILLETT, J. M. 1959. A revision of *Bartonia* and *Obolaria* (Gentianaceae). *Rhodora* 61:43-62.
GILLETT, J. M. 1963. *The Gentians of Canada, Alaska and Greenland. Research Branch, Canada Department of Agriculture, Publication 1180*. Canada Department of Agriculture, Ottawa, Ontario.
GMELIN, J. F. 1791. *Caroli a Linné. Systema Naturae per Regna Tria Naturae: Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis. Tomus II*. Impensis Georg. Emanuel Beer, Lipsiae (Leipzig).
GRISEBACH, A. H. R. 1837. Ord. LIX. Gentianeae Juss. pp. 54-71. In *Flora Boreali-Americana, Vol. 2*, W.J. Hooker (ed.). Henry G. Bohn, London.
GRISEBACH, A. H. R. 1838 ["1839"]. *Genera et Species Gentianearum adjectis Observationibus Quibusdam Phytogeographicis*. J.G. Cotta, Stuttgart and Tübingen.
GRISEBACH, A. H. R. 1845. Ordo CXXXII. Gentianaceae. pp. 38-141. In *Prodromus Systematis Naturalis Regni Vegetabilis, Vol. 9*, Candolle, A.P. de, and A. de Candolle (eds.). Fortin, Masson et Sociorum, Parisiis (Paris).
KREMERS, E. 1903. Johann David Schöpf. *Bulletin of the Lloyd Library* 6 (Reproduction Series 3):3-6.
KUSNEZOW, N. I. 1893. Neue Asiatische und Amerikanische Gentianen. *Trudy Imperatorskago S.-Peterburgskskago Botanicheskago Sada* 13:57-64.
KUSNEZOW, N. I. 1894. Podrod *Eugentiana* Kusnez. poda *Gentiana* Tournefort. Sistematicheskaja, morfologicheskaja i geograficheskaja obrabotka. Trudy S.-Peterburgskago Obshchestva Estestvoispytatelei:Otdelenie Botaniki 24..Republished in German translation1896-1904. *Trudy Imperatorskago S.-Peterburgskskago Botanicheskago Sada* 15:1-507.
MANSION, G. 2004. A new classification of the polyphyletic genus *Centaurium* Hill (Chironiinae, Gentianaceae): Description of the New World endemic *Zeltnera*, and reinstatement of *Gyrandra* Griseb. and *Schenkia* Griseb. *Taxon* 53:719-740.
MATHEWS, K. G., N. DUNNE, E. YORK, and L. STRUWE. 2009. A phylogenetic analysis and taxonomic revision of *Bartonia* (Gentianaceae: Gentianeae), based on molecular and morphological evidence. *Systematic Botany* 34:162-172.
MICHAUX, A. 1803. *Flora Boreali-Americana, Vol. 1*. Fratres Levrault, Parisiis and Argentorati (Paris and Strasbourg).
MELDERIS, A. 1972. *Centaurium* Hill. pp. 56-59. In *Flora Europaea*, Vol. 3, T.G. Tutin et al. (eds.). Cambridge University Press, Cambridge.
POSTER, L. S., J. S. PRINGLE, and L. STRUWE. 2015. Identification and descriptions of the Gentianaceae in New Jersey. *Bartonia* 67:1-34.
PRINGLE, J. S. 1966. *Gentiana puberulenta* sp. nov., a known but unnamed species of the North American prairies. *Rhodora* 68:209-214.
PRINGLE, J. S. 1967. Taxonomy of *Gentiana*, section *Pneumonanthae*, in eastern North America. *Brittonia* 19:1-32.
PRINGLE, J. S. 1978. Sectional and subgeneric names in *Gentiana* (Gentianaceae). *Sida* 7:232-247.
PRINGLE, J. S. 1995. Gentianaceae. *Flora of Ecuador* 53:1-131.
PRINGLE, J. S. 2003 ["2002"]. Nomenclature of the narrow-leaved fringed gentian of the Great Lakes region, *Gentianopsis virgata* (Raf.) Holub (Gentianaceae). *The Michigan Botanist* 41:137-140.
PRINGLE, J. S. 2008 ["2006"]. Authorship of the name *Centaurium pulchellum* (Gentianaceae). *The Michigan Botanist* 46:113-118.

PRINGLE, J. S. 2010. The identity of the Pacific North American species *Zeltnera muhlenbergii* (Gentianaceae) and its distinction from *Centaurium tenuiflorum* and other species with which it has been confused. *Madroño* 57:184-202.

PURSH, F. 1813 ["1814"]. *Flora Americae Septentrionalis; or, a Systematic Arrangement and Description of the Plants of North America*. White, Cochrane, and Co., London.

RAFINESQUE, C. S. 1818. [Review of] *Flora Americae Septentrionalis, or a systematic arrangement and description of the Plants of North America, &c.* By Frederick Pursh, 2 vols. 8vo. With 24 engravings. London, 1814. The American Monthly Magazine and Critical Review. 2: 170-176.

RAFINESQUE, C. S. 1828. *Medical Flora; or, Manual of the Medical Botany of the United States of North America, Vol. 1.* Atkinson & Alexander, Philadelphia.

RAFINESQUE, C. S. 1837 ("1836")-1838. *Flora Telluriana*. Published by the author, Philadelphia. [Taxa referable to the Gentianaceae in Part 3. 1837.]

RAFINESQUE, C. S. 1841. *Manual of the Medical Botany of the United States*. Published by the author, Philadelphia.

SCHMIDT, F. W. 1793-1794. *Flora Boëmica Inchoata. Exhibens Plantarum Regni Boëmiae Indigenarum Species*. I.G. Calve, Prague, Bohemia (now Czech Republic). (*Chironia* in Cent. 2. 1794.)

SMALL, J. K. 1903. *Flora of the Southeastern United States*, ed. 1. Published by the author, New York.

STAFLEU, F. A., AND R. S. COWAN. 1986. *Taxonomic Literature: A Selective Guide to Botanical Publications and Collections with Dates, Commentaries and Types, ed. 2. Vol. VI: Sti-Vuy*. Regnum Vegetabile 115. Bohn, Scheltema & Holkema, Utrecht.

STUCKEY, R. L. 1971. C.S. Rafinesque's North American vascular plants at the Academy of Natural Sciences of Philadelphia. *Brittonia* 23:191-208.

SWARTZ, O. 1783. *Gentiana pulchella*, en ny Svensk växt. *Kongliga Vetenskaps Academiens Nya Handlingar* 4: 85-87, tab. 3, figs. 8 and 9.

TSVELEV, N. N. 1993. Synopsis of the species of the family Gentianaceae in the flora of the Caucasus [Translated title]. *Botanicheskii Zhurnal* (Moscow & Leningrad) 78(6):131-138.

VOSS, E. G. 1966. Nomenclatural notes on monocots. *Rhodora* 68:434-463.

WALTER, T. 1788. *Flora Caroliniana*. J. Fraser, London, U.K.

WARD, D. B. 2006. The Thomas Walter typification project. I. Observations on the John Fraser folio. *Sida* 22:1111-1118.

WARD, D. B. 2007. Thomas Walter typification project, II: The known Walter types. *Journal of the Botanical Research Institute of Texas* 1:407-423.

WILBUR, R. L. 1955. A revision of the North American genus *Sabatia* (Gentianaceae). *Rhodora* 57:1-33, 43-71, 78-104.

WILBUR, R. L. 1989. The type species of the genus *Sabatia* Adanson (Gentianaceae). *Rhodora* 91:167-171.

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Xyris chapmanii, an Overlooked *Xyris* Species of the New Jersey Pine Barrens

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ABSTRACT. *Xyris chapmanii* E.L. Bridges & Orzell has recently been discovered extant in the Pine Barren region of southern New Jersey. Information substantiating this find and a key differentiating other local *Xyris* species is provided. Additionally, a history of the species is provided along with a species description, floristic composition, habitat, associated species, current range, and current status. Further discussion highlights historical collections originally misidentified and deposited in herbaria but later correctly identified and annotated by James W. Horn in 2009. The biogeographic significance of *X. chapmanii* in New Jersey is also discussed.

INTRODUCTION

Xyris chapmanii was described in 1990 based on material from the Gulf Coastal Plain in the Southern United States (Bridges and Orzell 1990). The first observation of this species was in Wood County Texas in August 1988. The species was named for Dr. Alvan Wentworth Chapman, who wrote *Flora of the Southern United States* in 1860. The first recognition of this plant as a species previously unknown in New Jersey was in July 2007, followed by more discoveries at additional locations in 2012 and 2013. However, it was not until 2009 that a species determination was made while analyzing a formerly misidentified herbarium specimen collected in 1959.

Xyris chapmanii

The species description for *X. chapmanii* from the original publication is reproduced herein:

"Perennial herb, solitary or loosely cespitose. 4.5-9.5 dm high, the roots slender fibrous, perennating by means of scaly yellow lateral buds from base of plant; base of plant often clothed with fibrous remains of old leaf bases, the bases set (1−)4-5(−7) cm deep in the substrate. Leaves erect, linear, (15−)47-58(−74) cm long, spirally twisted; sheaths 1/5-1/3 as long as blade, entire, a lustrous brown to purplish brown or pinkish purple, tapering gradually to blade, multicostate, carinate, with a paler marginal zone; blades flattened linear multicostate, strongly spirally twisted, green, (1.5−)2-4(−5) mm wide, surfaces and margins smooth. Sheaths of scape tight, lustrous brown to red brown, (10-)15-19 cm long, with narrowly lanceolate blunt blade (5−)7-8(−15) mm long, much shorter than the principal leaves. Scapes linear-filiform, 48-92 cm long, 1.5-2 mm wide at apex, spirally twisted, basally subterete, becoming slightly flattened and bicostate above, with 2-3 additional, less

prominent costae, the major costae distinctly scabro-papillose, the minor costae smooth or scabro-papillose. Spikes broadly ovoid, acute, (6−)10-11(−13) mm long, (5−)7-8 mm wide, several flowered, the bracts tightly spirally imbricate, orbicular, 6 mm long, 5-6 mm wide, lustrous brown with distinct ovate green (when fresh) dorsal areas. Lateral sepals included, slightly curvate, 5-6 mm long, keel slightly narrower than wings, entire to lacerate. Petal blades obovate, yellow, 3 mm long, tapering from 3 mm wide at apex to 2 mm wide at base, the truncate-rounded tip slightly erose. Staminodia bibrachiate, the branches densely penicillate. Capsule ellipsoid, ca. 4mm long, 2.5-3 mm wide, the placentation parietal. Seeds narrowly ellipsoidal (3:1), 0.6-0.8 mm long, translucent to opaque creamy yellowish white, darkened caudate at both ends, the base slightly bent, with distinct, brownish, regularly to irregularly spaced longitudinal striations and irregular, translucent, very faint cross partitions. Flowering from August to September, with mature seeds from September to October. Flowers opening in late morning (petal blades unfolding from 2-3 hours after sunrise), closing near midday (Bridges and Orzell 1990)."

A Key for Determining *Xyris chapmanii* in New Jersey

Using the *Manual of Vascular Plants of Northeastern United States and Adjacent Canada* (Gleason and Cronquist 1991), substitute the following key for couplet 2 to distinguish *X. chapmanii* from other New Jersey species having the keel of the lateral sepals merely lacerate or entire, and with spikes 0.5-1.5 cm.

2. Mature spikes mostly 1.5-3.5 cm.
2. Mature spikes mostly 0.5-1.5 cm.
    5. Seeds 0.6-1.0 mm.
        6. Mostly densely tufted, lvs mostly 4-15 cm long..... *X. montana*
        6. Solitary or loosely cespitose, lvs usually greater than 15 cm long.....*X. chapmanii*
    5. Seeds ca. 0.5 mm.
        7. Plant base stramineous or yellow-green; lvs ascending; NJ and south ... *X. jupicai*
        7. Plant base generally anthocyanic; lvs spreading; generally widespread .*X. difformis*

Key Morphological Comparisons with Similar Local New Jersey Species

Casual field identification of *X. chapmanii* in situ without magnification is problematic. The authors have seen both *Xyris torta* and *Xyris difformis* in the field that compare favorably with *X. chapmanii* at first glance. However, *X. chapmanii* has larger, more elongated seeds than either *X. torta* or *X. difformis*. In New Jersey, *X. chapmanii* seeds are consistently 0.8-0.85(-0.9) mm long, while *X. torta* and *X. difformis* have seeds 0.5-0.6 mm long (Figure 1).

Another distinguishing characteristic is the plant base on *X. chapmanii*, which has striking, yellow-colored lateral leaf buds which can usually be seen all year, even during the growing season. *X. torta* has a tight, fleshy, swollen base, often appearing bulbous, and *X. difformis* has buds that tend to be more whitish in color, more narrow, and the tips are longer. *X. difformis* also tends to exhibit "fanning" out of the leaves from the base, whereas the leaf bases on *X. chapmanii* tend to align themselves parallel with the scape (Figures 2 and 3).

History of *Xyris chapmanii*, and its Current Range and Status

Xyris chapmanii was described in 1990 based on material from eleven sites in Alabama, Florida, Mississippi, and Texas (Bridges and Orzell 1990). Later that year, it was found at

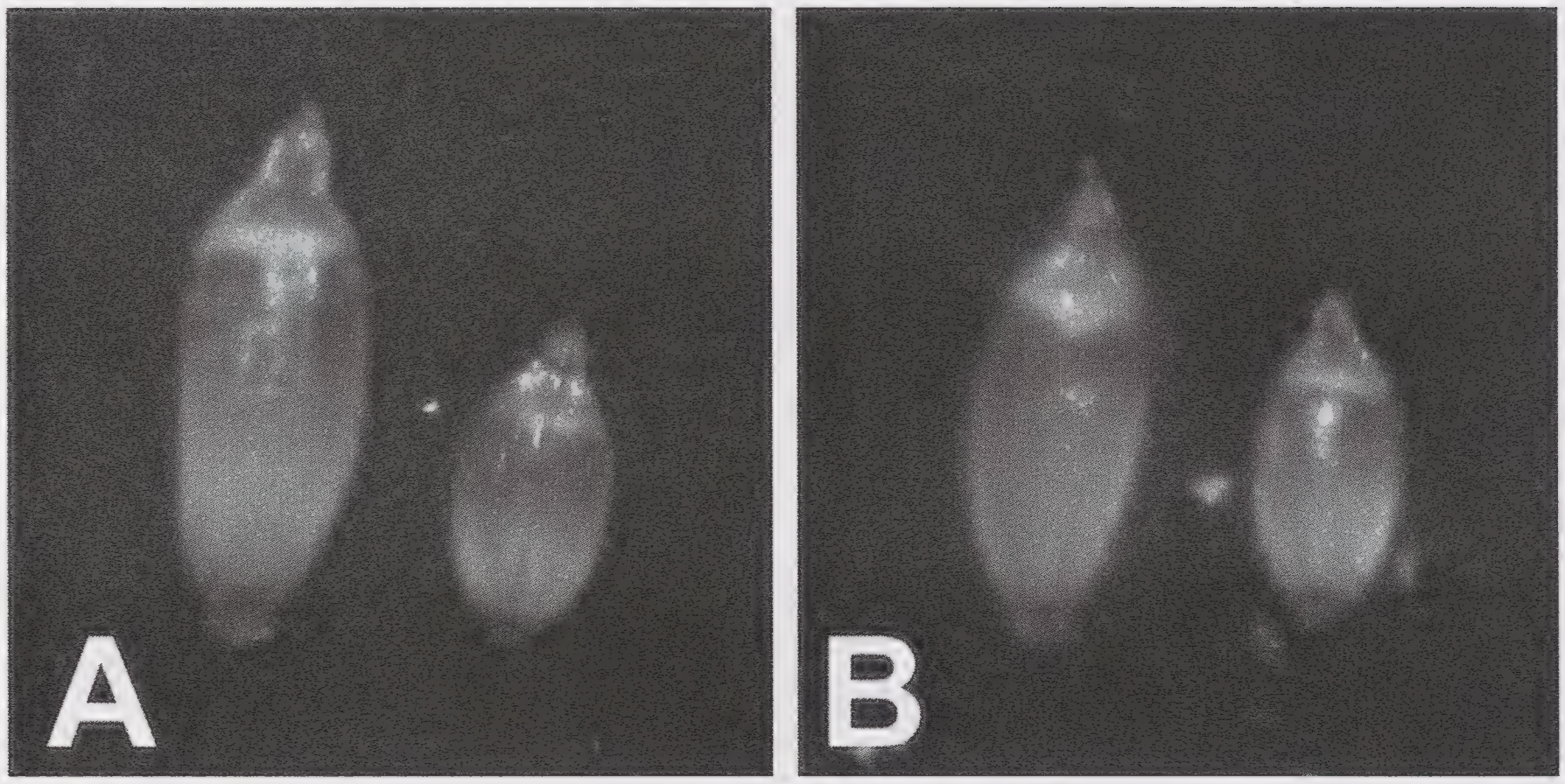

Figure 1. *Xyris chapmanii* seeds are consistently larger than those of *X. difformis* and *X. torta.* A) *X. chapmanii* seed (left) compared with *X. difformis seed* (right). B) *X. chapmanii* seed (left) compared with X. torta seed (right).

a single site in Marion County, Georgia (Sheridan et al. 1997), and one additional site was located in Santa Rosa County, Florida. In 1992, Bruce Sorrie found a remarkable disjunct location for *X. chapmanii* in Cumberland County, North Carolina, and by 1997 it was known to occur at 15 sites in five counties in North Carolina (Sorrie et al. 1997). Meanwhile, it had been collected in 1993 in South Carolina, and by 2002 was known from three counties in that state (McMillan et al. 2002).

Kral (2000) treated *X. chapmanii* as synonymous with *X. scabrifolia* in the *Flora of North America*. His description of *X. scabrifolia* was expanded (from the description in Kral [1966], and Godfrey and Wooten [1979]) to include most of the distinctive characters of *X. chapmanii* as within the range of variation of *X. scabrifolia*. In this treatment, Kral stated that several specimens determined as *X. chapmanii* showed intergradation with *X. scabrifolia*, and that it was impossible to separate the two, even as varieties.

This conclusion is at odds with the experience of most field botanists of the southeastern United States, who are consistently able to distinguish *X. chapmanii* from *X. scabrifolia*. Despite careful examination of hundreds of individuals in populations where *X. scabrifolia* and *X. chapmanii* are in close proximity, no intermediate forms have been seen by Bridges or Orzell in studies of field sites from North Carolina to Texas, or by other botanists carefully studying these species in North Carolina, South Carolina, and Texas. Detailed alternative keys to *Xyris* which include *X. chapmanii* can be found in Bridges and Orzell (2003), Ward (2007), and Weakley (2012).

Over the past decade, *X. chapmanii* has been increasingly recognized as a valid species. It is now listed as a rare, threatened, endangered, or special concern species by the state rare plant programs of Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Texas, and now New Jersey according to David Snyder, NJ State Botanist (personal communication; unreferenced). It is recognized as a valid species by the USDA Plants national database (http://plants.usda.gov) and by the Biota of North America Program (http://www.bonap.org). Figure 4 gives the current county-level distribution of *X. chapmanii*, with only one dot per county regardless of how many sites are known from each.

Figure 2. Perennating leaf buds of *X. difformis* (left) and *X. chapmanii* (right).

Habitat and New Jersey Locations

Throughout its southern range, *X. chapmanii* occurs in extremely rare and specialized habitats, usually in constantly saturated histosols, often in "quaking bogs" where the root mass of the herbaceous-dominated vegetation is floating on a mucky soup of organic material suspended in diffuse spring-fed groundwater. These habitats are maintained by copious diffuse groundwater seepage from the adjacent sandy uplands. Although small slow-flowing seepage streams form within some of these sites, they are usually not well-defined spring runs, such as would occur from a localized point source spring. Despite the wide geographic range of *X. chapmanii*, the general habitat conditions are remarkably similar through its southern range.

The habitat in the New Jersey Pine Barrens is nearly identical, and is best described as saturated palustrine wetland subsystems classified as Pine Barrens Riverside Shrub Savanna, or a Pine Barrens Riverside Bog Asphodel Savanna (NatureServe, 2013). Within these system types *X. chapmanii* grows in sphagnum or in hydric organic soil classified as saturated peat

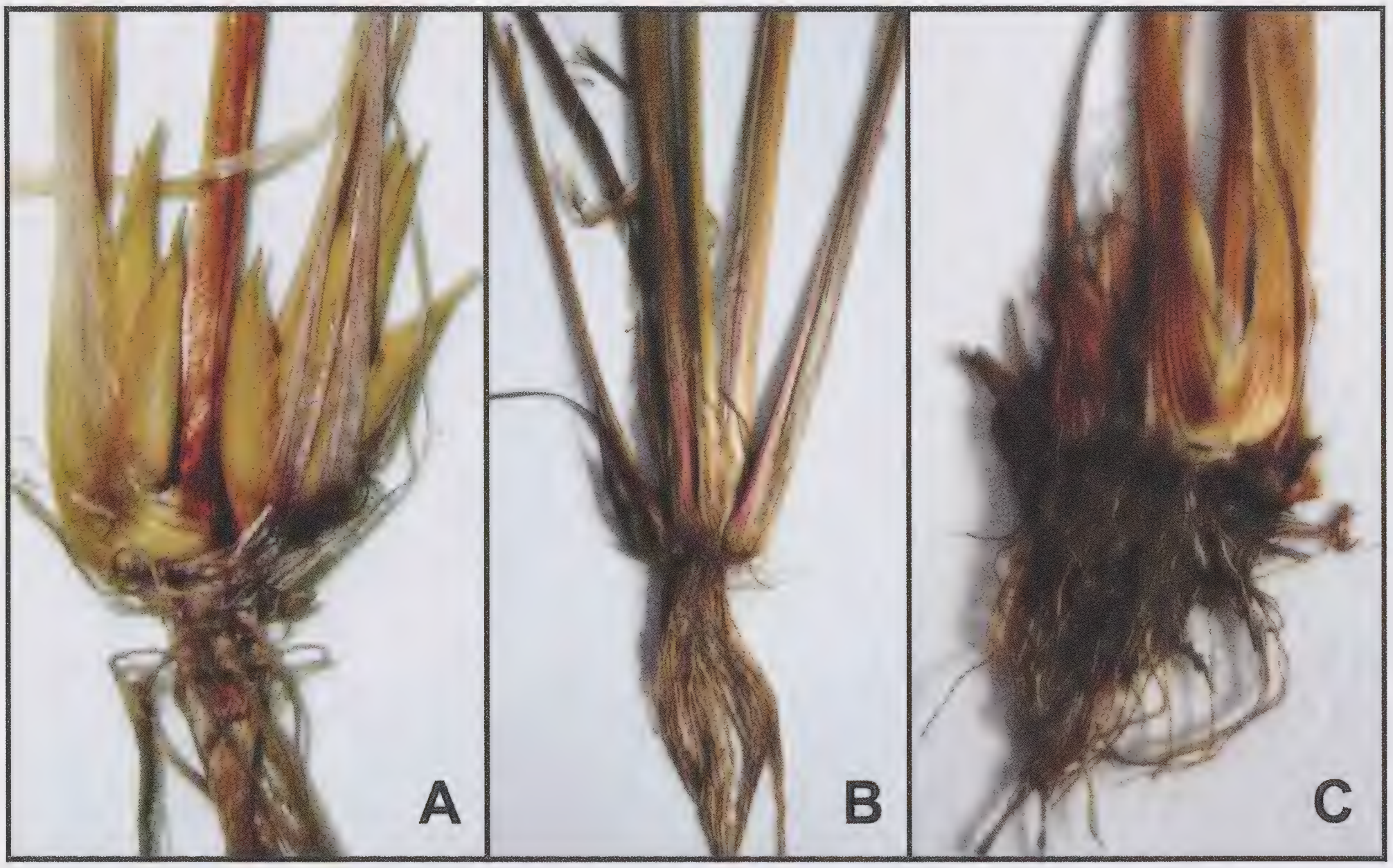

Figure 3. Comparison of *Xyris* species plant bases showing differences in lateral leaf bud color, leaf base thickness, and angle of leaf base orientation. A) *X. chapmanii,* B) *X. difformis*, and C) *X. torta.*

(Federal Interagency Committee for Wetland Delineation, 1989). Groundwater seepage is constant; creating pools and often forming small sluggish streams that flow to an adjacent creek or river. *X. chapmanii*, to a lesser degree, is also found within these pools and streams, growing on a submerged bed of peat.

Xyris chapmanii has been confirmed at five New Jersey locations. Estimated population size and habitat area, for four of these locations, are presented in Table 1. Exact locations are not provided due to habitat sensitivity, the extreme rarity of the plant, and its vulnerability to over-collection. For professionals conducting research, the authors can be contacted for exact locations. Voucher specimens collected on 13 January, 2014, for location 5 below have been deposited at PH (Moyer G0204), CHRB (Moyer G0206), and NY (Moyer, G0205).

1. Ocean Co.: Cedar Creek watershed, 0.67 km NNE from the spillway dam on Bamber Lake at the village of Bamber.
2. Ocean Co.: Cedar Creek watershed, 1.28 km NW from the spillway at long-abandoned Dover Forge.
3. Ocean Co.: Oyster Creek watershed, 0.34 km WSW from where Oyster Creek crosses County route 532.
4. Burlington Co.: Mount Misery Brook watershed, 1.31 km SE from where NJ state highway route 70 crosses Mount Misery Brook.
5. Burlington Co.: Batsto River watershed, 2.6 km N from the dam at the southern end of the lake at Batsto Village.

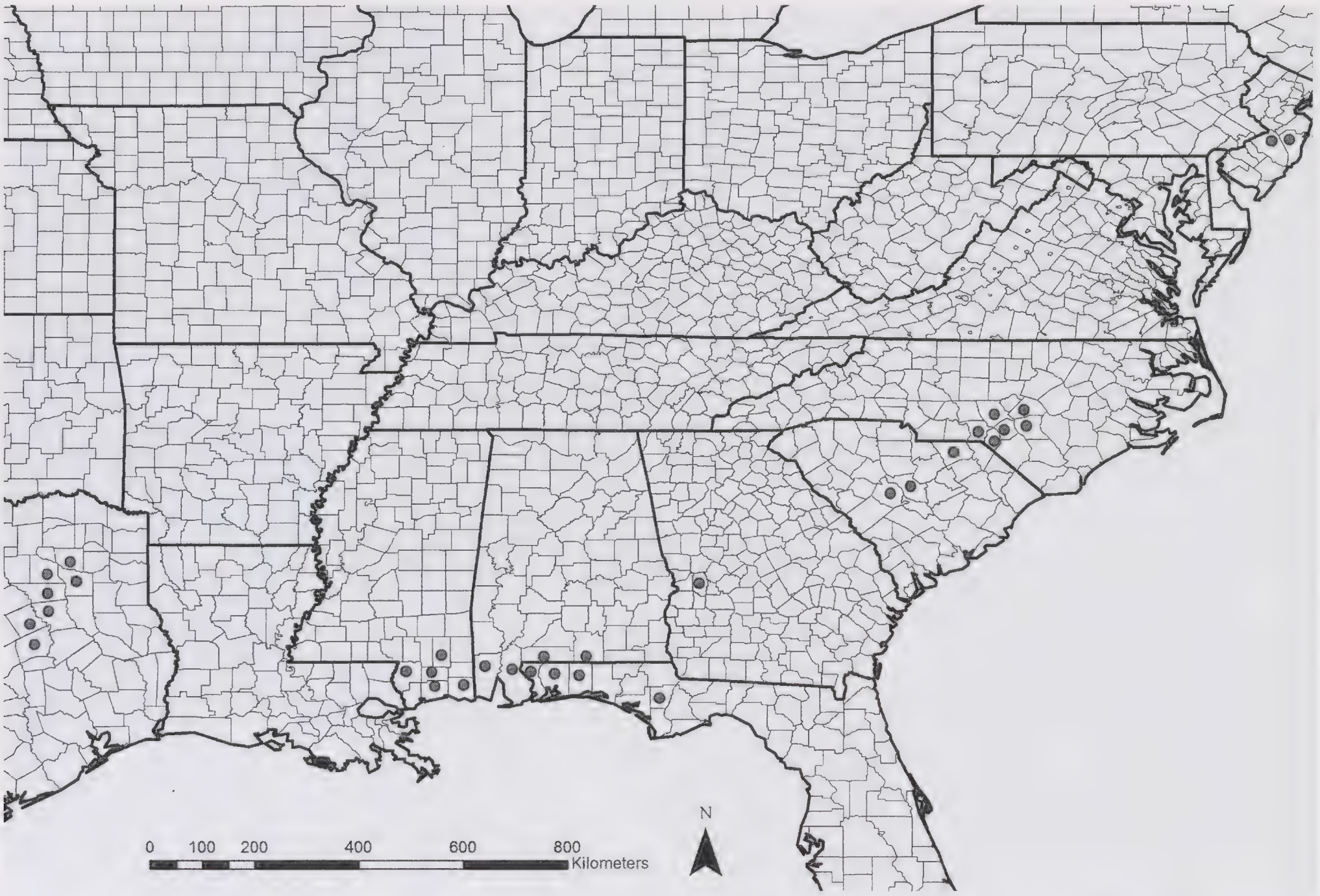

Figure 4. County-level distribution of *Xyris chapmanii*. Each dot may represent more than one site.

The habitats at the New Jersey locations can appear quite different upon first glance, but the common denominator is the persistently saturated organic soil (peat). Figure 5 depicts an area along Cedar Creek in Ocean County where groundwater rises and pools at the base of an upland. Dominant in the transition zone is Atlantic white cedar (*Chamaecyparis thyoides*), ericaceous shrubs, and sedges. *X. chapmanii* grows in the transition zone (see Figure 6), as well as in adjacent pools. These photos were taken in the summer. Figure 7 was taken in the winter along the Batsto River in Burlington County. The dominant species are Atlantic White Cedar juveniles and sedges. *X. chapmanii* grows among these cedars and sedges, and is difficult to spot due to the lack of contrast.

A search was made of *Xyris* specimens at PH, NY, BKL, and CHRB to determine whether there were previous New Jersey collections of *X. chapmanii* that predated its description,

Table 1. Locations and estimated population sizes for *Xyris chapmanii* occurrences in the New Jersey pine barrens (Batsto River site excluded).

	Ocean Co. 1	**Ocean Co. 2**	**Ocean Co. 3**	**Burlington Co. 1**
watershed	Cedar Creek	Cedar Creek	Oyster Creek	Mount Misery Brook
estimated individuals	150-200	200-250	<50	200-250
estimated area (ha)	.05	.20	.13	.08

Figure 5. Habitat along Cedar Creek Watershed, Ocean Co., NJ.

and therefore may have been determined and filed as another *Xyris* species. None were found at PH nor CHRB, however, investigations at NY and BKL led to the following finds:

BKL: A specimen sheet *James Lendemer and Moira Moody*, Sept. 2003 (BKL00075697) sheet containing six *Xyris* plants labeled as *X. difformis* was determined by the authors to be a mixture of *X. chapmanii* (3) and *X. difformis* (3). These plants were collected in Burlington County in the upper Oswego River watershed, 3.6 km northeast of the Pinelands Village of Warren Grove. The new determination was annotated on the sheet and dated February 2014 by R. Moyer.

NY: A single specimen at NY, *G. Eiten, K.L. Brooks, and L. Jenson 1423*, Aug. 1959, had been determined as *X. chapmanii* by J. W. Horn in 2009. This specimen was collected

Figure 6. *X. chapmanii* in sphagnum; Cedar Creek, Ocean Co., NJ.

in Burlington County, "near village of Mount Misery…headwaters of North Branch of Rancocas creek". This site description matches the location of our Burlington County site. This specimen was originally determined as *Xyris flexuosa* Muhl., and later determined as *X. torta* by R. Kral in 1965.

BH: Following the NY find, James W. Horn was contacted by the authors for further information. Dr. Horn revealed there are three other specimens at BH collected from New Jersey that he determined were also *X. chapmanii* (personal communication; unreferenced). These were collected from 1936 to 1942, but the location data is too vague to determine if the habitat still exists. The label data prior to annotating as *X. chapmanii* is as follows:

Xyris flexuosa
Forked River, Ocean Co.
J. Cohn, 5 Oct. 1941

Figure 7. Habitat along the Batsto River Watershed, Burlington Co., NJ.

Xyris torta J.E. Smith
Wet ground along railroad south of Lakewood, Ocean County
R.F. Thorne, 16 Sept. 1942

Xyris caroliniana Walt.
Open bog, Chatsworth, Burlington, County
H.W. Blaser, 23 Aug. 1936

Floristic Composition and Associated Species of *Xyris chapmanii*

Floristic data from *X. chapmanii* habitats has been compiled from 65 sites throughout the range of the species. For biogeographic analysis purposes, these have been divided into five regional subsets based on both geography and on coastal plain floristic patterns described in Sorrie and Weakley (2001) as follows:

1. Fall line sandhills of the Carolinas and Georgia – thirteen sites, with the flora of the Carolinas sites compiled by Bridges and Orzell in July 1996, and the Georgia site by Bridges and Orzell in 1990.

2. Western Florida Panhandle and Southeast Alabama – sixteen sites, with the flora compiled by Bridges and Orzell between 1987 and 1994. This represents the region of phytogeographic pattern 12 in Sorrie and Weakley (2001), with the Mobile River as its western boundary.

3. Southern Mississippi and Southwest Alabama – nine sites, west of the Mobile River, with the flora compiled by Bridges and Orzell between 1987 and 2000. This represents the part of phytogeographic pattern 11 in Sorrie and Weakley (2001) not included in the previous region.

4. Texas Post Oak Ecoregion – twenty-four sites, all in a narrow band of the deep Eocene sand formations of Texas, all northwest of the Longleaf Pine region of the coastal plain, with the flora compiled by Bridges, Orzell, and Jason Singhurst between 1986 and 2007.

5. New Jersey Pine Barrens region – Six sites (2003-2013), if we count the specimens from BKL, with the flora of three of these sites compiled by Bob Moyer (Table 2).

As would be expected, there is a wide variation in the floristic composition of *X. chapmanii* sites over such a wide range. Yet, there is also a surprising degree of similarity, with thirteen species associated with *X. chapmanii* in all five regions, and 26 additional species found at both the NJ sites and site in at least one other region (Table 3). Only 24 of the New Jersey associates of *X. chapmanii* are not known from *X. chapmanii* sites in any other part of its range. However, even in many of these cases, these can be thought of as northern-southern "species pairs," where a similar species occurs at the southern sites, including *Drosera filiformis – D. tracyi*, *Eriocaulon aquaticum – E. texense*, *Juncus caesariensis – J. trigonocarpus*, *Platanthera blephariglottis – P. conspicua*, and *Rhynchospora alba – R. macra*. These related vicariants also include the members of the family Nartheciaceae (*Aletris, Lophiola, Narthecium*) and the morphologically similar Tofieldiaceae (*Pleea, Triantha*), as well as the *Sarracenia purpurea* complex (var. *purpurea*, var. *venosa*, and *S. rosea*).

Among the associates shared between New Jersey and other regions are a group which are more commonly associated with *X. chapmanii* in Texas than in the other regions – including *Decodon verticillatus*, *Eleocharis tortilis*, *Lycopodiella appressa*, *Triadenum virginicum*, *Utricularia cornuta*, and *X. difformis*. In general, these are wetland generalists in the southeast, which tend to be more common inland and to the north.

The southern sites for *X. chapmanii* (all regions except New Jersey) are, for the most part, extremely rich in vascular plant species with an average of 99 vascular plants per site recorded at the 62 sites surveyed. Several sites had more than 120 species present in the *X. chapmanii* habitat, with the maximum recorded as 180 species at one Alabama site, among the highest vascular plant diversity recorded for a single natural community at any site in North America. Therefore, the number of vascular plants associated with *X. chapmanii* represented in at least one of the documented sites is very large (543 taxa), and the full table of associated species is not presented here. Table 4 lists the species associated with *X. chapmanii* at 50% or more of its sites in the southern United States, with most of these being present in all four of the southern regions of occurrence.

Discussion

Biogeographic Significance of *Xyris chapmanii* in New Jersey

The New Jersey locations for *X. chapmanii* are disjunct about 650 km from the nearest locations for this species in North Carolina. Coincidentally, the Texas locations for *X. chapmanii* are disjunct nearly the same distance (630 to 670 km) from the nearest confirmed

Table 2. Species associated with *Xyris chapmanii* at three sites in New Jersey.

Species	Ocean Co. 1	Ocean Co. 2	Burlington Co. 1	Status[1]
Acer rubrum	X	—	—	
Agrostis perennans var. elata	—	—	X	
Andropogon glomeratus	X	X	X	
Bartonia paniculata	X	X	X	
Calopogon tuberosus	—	X	—	
Carex atlantica	X	—	—	
Carex collinsii	X	X	—	
Carex exilis	—	—	X	
Carex striata	X	X	X	
Chamaecyparis thyoides	X	X	X	
Chamaedaphne calyculata	—	X	X	
Cladium mariscoides	—	—	X	
Clethra alnifolia	X	X	—	
Decodon verticillatus	X	—	—	
Dichanthelium sp.	X	—	—	
Drosera filiformis	—	X	—	
Drosera intermedia	X	X	X	
Drosera rotundifolia	X	X	X	
Eleocharis tortilis	X	—	—	NJ
Eriocaulon aquaticum	—	—	X	
Eriocaulon compressum	—	X	X	
Eriophorum virginicum	X	—	—	
Gaylussacia dumosa	X	X	X	
Gaylussacia frondosa	X	X	X	
Helonias bullata	X	—	—	NJ, P
Hypericum canadense	—	—	X	
Hypericum virginicum	—	—	X	
Ilex glabra	X	X	X	
Ilex laevigata	X	—	X	
Juncus caesariensis	X	X	—	NJ, P
Juncus canadensis	X	—	X	
Juncus pelocarpus	X	X	X	
Kalmia angustifolia	X	X	X	
Lophiola aurea	—	—	X	
Lycopodiella appressa	—	—	X	
Lycopodiella caroliniana	—	—	X	
Lycopodiella × copelandii	—	—	X	

Species	Ocean Co. 1	Ocean Co. 2	Burlington Co. 1	Status[1]
Magnolia virginiana	X	—	—	
Morella caroliniensis	X	X	X	
Muhlenbergia uniflora	—	X	X	
Narthecium americanum	—	X	—	NJ, P
Nymphea odorata	—	X	X	
Oclemena nemoralis	X	X	X	
Osmundastrum cinnamomea	X	X	—	
Platanthera blephariglottis	X	X	X	
Platanthera clavellata	X	—	—	
Pogonia ophioglossoides	X	X	X	
Polygala brevifolia	X	X	X	
Polygala cruciata	—	X	—	
Rhynchospora alba	X	X	X	
Rhynchospora gracilenta	—	X	—	
Sabatia difformis	—	X	—	
Sarracenia purpurea	X	X	X	
Sassafras albidum	X	—	—	
Schizaea pusilla	X	X	X	P
Sphagnum sp.	X	X	X	
Symphyotrichum nova-belgii	X	—	—	
Utricularia cornuta	—	X	X	
Utricularia striata	X	X	X	
Utricularia subulata	—	X	—	
Vacinnium corymbosum	—	—	X	
Vacinnium macrocarpon	X	X	X	
Woodwardia virginica	X	—	—	
Xyris chapmanii	X	X	X	
Xyris difformis	X	—	—	

Ecotone Margin[2]	Ocean Co. 1	Ocean Co. 2	Burlington Co. 1	Status
Andropogon glomeratus	X	—	X	
Betula populifolia	X	—	—	
Carex collinsii	X	X	X	
Chamaecyparis thyoides	X	X	X	
Clethra alnifolia	X	X	X	
Gaylussacia frondosa	X	X	X	
Helonias bullata	X	—	—	NJ, P
Ilex opaca	X	—	—	

Species	Ocean Co. 1	Ocean Co. 2	Burlington Co. 1	Status[1]
Kalmia latifolia	X	—	X	
Nyssa sylvatica	X	X	—	
Orontium aquaticum	—	X	X	
Sassafras albidum	X	X	—	
Smilax rotundifolia	X	X	—	

[1]Status: NJ = New Jersey State Endangered; P = Pinelands Threatened or Endangered.
[2]Although some also represented above, those listed as associated are much reduced in size.

Table 3. Floristic composition of *Xyris chapmanii* sites

Species	NJ n=3	NC-SC-GA n=13	FL/SE AL n=16	MS-SW AL n=9	TX n=24	TOTAL SE US n=62
Acer rubrum (incl. var. trilobum)	1	12	13	8	13	46
Agrostis perennans	1				1	1
Andropogon glomeratus var. glomeratus	3	11	8	6	18	43
Bartonia paniculata	3		3	7	9	19
Calopogon tuberosus	1	3	8	8	8	27
Carex atlantica subsp. atlantica	1	7	3	2	7	19
Carex collinsii	2	3				3
Carex exilis	1	3	3	5		11
Chamaecyparis thyoides	3	1	1			2
Cladium mariscoides	1	2			2	4
Clethra alnifolia	2	10	7	1		18
Decodon verticillatus	1				6	6
Drosera intermedia	3	6	3	3		12
Drosera rotundifolia	3	5				5
Eleocharis tortilis	1	1			14	15
Eriocaulon compressum	2	2	10	6		18
Eriophorum virginicum	1	3				3
Gaylussacia dumosa	3	1				1
Gaylussacia frondosa	3	10				10
Hypericum canadense	1	2	3	1		6
Ilex glabra	3	11	15	8		34
Lophiola aurea	1		15	9		24
Lycopodiella appressa	1	3	6	3	15	27
Lycopodiella caroliniana	1	4	13	6	7	30
Magnolia virginiana	1	13	15	9	1	38
Morella carolinensis	3	13	16	9		38
Nymphaea odorata	2				2	2
Osmundastrum cinnamomea	2	11	9	6	17	43

Species	NJ n=3	NC-SC-GA n=13	FL/SE AL n=16	MS-SW AL n=9	TX n=24	TOTAL SE US n=62
Pogonia ophioglossoides	3	9	11	8	16	44
Polygala brevifolia	3		6			6
Polygala cruciata	1	2	13	7	14	36
Rhynchospora gracilenta	1	12	9	5	23	49
Sabatia difformis	1	10				10
Sphagnum spp.	3	12	14	9	21	56
Triadenum virginicum	1	2		1	14	17
Utricularia cornuta	2				11	11
Utricularia subulata	1	4	7	5	4	20
Woodwardia virginica	1	7	8	3	3	21
Xyris difformis	1				14	14

Table 4. Species associated with *Xyris chapmanii* at ≥50% of the sites in the southern U.S.

Species	NC-SC-GA (n=13)	FL-SE AL (n=16)	MS-SW AL (n=9)	TX (n=24)	TOTAL SE US (n=62)
Eriocaulon decangulare	9	16	9	24	58
Juncus trigonocarpus	12	16	7	23	58
Fuirena squarrosa	10	16	8	23	57
Sphagnum spp.	12	14	9	21	56
Rhynchospora chalarocephala	13	14	5	23	55
Smilax laurifolia	13	15	9	18	55
Nyssa sylvatica var. biflora	8	13	7	22	50
Drosera capillaris	6	15	8	20	49
Eupatorium rotundifolium	12	12	2	23	49
Rhynchospora gracilenta	12	9	5	23	49
Scleria muehlenbergii	3	16	8	22	49
Eryngium integrifolium	2	15	9	22	48
Acer rubrum var. trilobum	12	13	8	13	46
Xyris ambigua	10	14	9	13	46
Pogonia ophioglossoides	9	11	8	16	44
Xyris baldwiniana	8	14	9	13	44
Andropogon glomeratus var. glomeratus	11	8	6	18	43
Hypericum crux-andreae	7	14	2	20	43
Osmundastrum cinnamomea	11	9	6	17	43
Dichanthelium scabriusculum	8	8	5	20	41
Helianthus angustifolius	6	11	2	22	41
Burmannia capitata	1	11	7	21	40
Rhynchospora oligantha	5	11	7	17	40

Species	NC-SC-GA (n=13)	FL-SE AL (n=16)	MS-SW AL (n=9)	TX (n=24)	TOTAL SE US (n=62)
Magnolia virginiana	13	15	9	1	38
Morella carolinensis	13	16	9	--	38
Rhynchospora stenophylla	12	14	8	4	38
Viburnum nudum	9	12	5	12	38
Ilex coriacea	12	16	9	--	37
Rhynchospora macra	1	15	8	13	37
Arundinaria gigantea	12	16	8	--	36
Eriocaulon texense	4	13	4	15	36
Polygala cruciata	2	13	7	14	36
Rhexia virginica	5	7	1	23	36
Aster dumosus	7	8	4	16	35
Centella asiatica	3	10	8	14	35
Dichanthelium dichotomum	2	8	1	24	35
Saccharum giganteum	5	5	1	24	35
Coreopsis linifolia	2	16	8	8	34
Ilex glabra	11	15	8	--	34
Xyris scabrifolia	7	15	8	4	34
Osmunda regalis var. spectabilis	6	4	5	18	33
Panicum virgatum	7	4	2	19	32
Rhexia petiolata	10	13	9	--	32
Eleocharis tuberculosa	11	11	4	5	31
Rhexia alifanus	9	14	8	--	31
Xyris fimbriata	9	14	8	--	31

locations in southern Mississippi. Such long-distance disjunctions are relatively uncommon, particularly for species with high fidelity to very restricted and rare habitats. Often, long-distance disjunctions follow recognizable patterns, with other species with similarly restricted habitats found in association, at least at some sites within each region. Even the Georgia site is a rather significant disjunct location, being about 225 km north of the nearest Alabama and Florida sites, and 350 km southwest of the nearest South Carolina site.

While we cannot definitively state that *X. chapmanii* never occurred in Virginia, Maryland, or Delaware, many of the species which are associated with *X. chapmanii* are absent from or extremely rare in those states. There is some hope that *X. chapmanii* could be located in a natural or human-maintained herbaceous-dominated boggy seepage area in Maryland or Virginia, perhaps at sites known to support *Juncus caesariensis*, *Rhynchospora alba*, and *Sarracenia purpurea* (Sheridan et al. 1997).

The habitat types for *X. chapmanii* throughout most of its range have been known for their richness of rare, disjunct, and habitat-specific species. For example, *Cladium mariscoides*, which is found with *X. chapmanii* at some sites in Texas, North Carolina, and New Jersey, is a very restricted disjunct species in the southern United States (Bridges and

Orzell 1989, Bridges et al 1993). Although not all of its southern United States sites are in *X. chapmanii* habitat, all of its Texas and North Carolina sandhill region sites are found in the same community types as *X. chapmanii*. The co-occurrence of these species at sites over 1700 km apart, with few to no intervening sites for either species in the inner coastal plain, indicates a very high degree of habitat restriction and the inherent rarity of these habitats in the current landscape.

Another long-disjunct species strongly associated with *X. chapmanii* sites is *Carex exilis*. This very distinct sedge is found with *X. chapmanii* in New Jersey (where it is also found at many other sites), and in North Carolina, Alabama, and Mississippi (Bryson et al. 1988, Orzell and Bridges 1991, Sorrie et al 1997). In the southern states, *C. exilis* is found at no other sites than those supporting *X. chapmanii*, and it is a long-distance disjunct to the Alabama and Mississippi sites from the North Carolina *X. chapmanii* sites.

Several other species found with *X. chapmanii* at the North Carolina sites are shared with some New Jersey sites, but are uncommon or absent in the intervening region, including *Eriophorum virginicum*, *Drosera rotundifolia*, and *Lophiola aurea*. *Calamovilfa brevipilis*, *Eupatorium resinosum*, and *Rhynchospora pallida*, which are found with *X. chapmanii* in North Carolina, are also very uncommon between North Carolina and New Jersey, although not occurring with *X. chapmanii* in New Jersey. Some of these represent the bimodal (s. NJ-DE to e. NC and SC) distribution pattern in Sorrie and Weakley (2001), of species which are apparently absent from Virginia and Maryland. Conversely, the New Jersey associated species *Chamaedaphne calyculata*, *Drosera filiformis*, *Eriocaulon aquaticum*, *Juncus pelocarpus*, *Schizaea pusilla*, and *Symphyotrichum nova-belgii* (Table 2) occur in the Coastal Plain of North Carolina, South Carolina, and/or Florida, but not at the *X. chapmanii* sites in those states. There are some species of the New Jersey sites that are at or near their northernmost locations, with some being disjunct with the nearest sites in southeastern North Carolina. Among those absent or nearly so from Virginia and Maryland are *Eriocaulon compressum*, *Lycopodiella x copelandii*, *Lycopodiella caroliniana*, and *Polygala brevifolia*.

In conclusion, long-disjunct populations of rare and habitat-restricted species are of critical biodiversity importance, almost as much as narrowly endemic species. These populations are very likely to have genetic diversity that is quite different from populations of the same species within the main body of the species' range, and are present-day natural laboratories of genetic selection, evolution, and perhaps of speciation. They also may represent relictual populations which have survived for thousands of years in isolation. *X. chapmanii* in New Jersey, as well as in much of its range, has many of the characteristics of a relictual species, and adds to our understanding of the relationships between the New Jersey Pine Barrens region and the southeastern United States coastal plain.

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he is credited with the first determination of *X. chapmanii* collected in New Jersey. Guy Thompson and Jessica Thompson are thanked for providing assistance during New Jersey field surveys.

Literature Cited

Bridges, E. L. and S. L. Orzell. 1989. Additions and noteworthy vascular plant collections from Texas and Louisiana, with historical, ecological, and geographical notes. *Phytologia* 66:12-69.

Bridges, E. L. and S. L. Orzell. 1990. *Xyris chapmanii*, a new species from the Gulf Coastal Plain of the Southern United States. *Phytologia* 68:382-389.

Bridges, E. L. and S. L. Orzell. 2003. Two new species and a new combination in southeastern United States *Xyris* (Xyridaceae) from Florida. *Novon* 13:16-25.

Bridges, E. L., S. L. Orzell and J. R. Burkhalter. 1993. *Cladium mariscoides* in the western Florida panhandle, and its phytogeographic significance. *Phytologia* 74:35-42.

Bryson, C. T., W. McDearman and K. L. Gordon. 1988. *Carex exilis* Dewey (Cyperaceae) in Mississippi Bogs. *Sida* 13:171-175.

Federal Interagency Committee for Wetland Delineation. 1989. Federal Manual for Identifying and Delineating Jurisdictional Wetlands. Cooperative technical publication. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington, D.C. 76 pp. plus appendices.

Gleason, H. A., and A. Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada, 2nd ed.* New York Botanical Garden, New York. 910 pp.

Godfrey, R. K., and J. Wooten. 1979. *Aquatic and Wetland Plants of Southeastern United States - Monocotyledons*. University of Georgia Press, Athens. 712 pp.

Kral, R. 1966. *Xyris* (Xyridaceae) of the continental United States and Canada. *Sida* 2:177-260.

Kral, R. 2000. *Xyris*. pp. 155-167. In *Flora of North America North of Mexico. Vol. 22.* Flora of North America Editorial Committee, (eds.). *1993+*. Oxford University Press, New York. Available from: http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=135197

McMillan, P. D., R. K. Peet, R. D. Porcher, and B. A. Sorrie. 2002. Noteworthy botanical collections from the fire-maintained pineland and wetland communities of the coastal plain of the Carolinas and Georgia. *Castanea* 67:61-83.

NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available from: http://www.natureserve.org/explorer. (Accessed: 14 January 2014).

Orzell, S. L. and E. L. Bridges. 1991. *Carex exilis* Dewey (Cyperaceae) new to Alabama. *Phytologia* 70:400-403.

Sheridan, P. M., S. L. Orzell, and E. L. Bridges. 1997. Powerline easements as refugia for state rare seepage and pineland plant taxa. pp. 451-460. In *The Sixth International Symposium on Environmental Concerns in Rights-of-Way Management. 24-26 February 1997, New Orleans. Louisiana, USA*. J. R. Williams, J. W. Goodrich-Mahoney, J. R. Wisniewski and J. Wisniewski (eds.). Elsevier Science, Oxford.

Sorrie, B. A., B. VanEerden, and M. J. Russo. 1997. Noteworthy plants from Fort Bragg and Camp MacKall, North Carolina. *Castanea* 62:239-259.

Sorrie, B. A. and A. S. Weakley. 2001. Coastal plain vascular plant endemics: phytogeographic patterns. *Castanea* 66:50-82

USDA, NRCS. 2013. The PLANTS Database. Available from: http://plants.usda.gov. National Plant Data Team, Greensboro, NC 27401-4901 USA. (Accessed:18 October 2013).

Ward, D. B. 2007. Keys to the flora of Florida – 16: Xyris (Xyridaceae). *Phytologia* 89:167-177.

Weakley, A. S. 2012. *Flora of the Southern and Mid-Atlantic States. Working Draft of 28 September 2012*. University of North Carolina Herbarium, North Carolina Botanical Garden, Chapel Hill, NC. Available from: http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2012-Nov.pdf

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Arborescent Composition of Bostwick Forest, Gardiners Island, New York

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ABSTRACT. Bostwick Forest may be one of the largest and oldest *Quercus*-dominated, old-growth coastal forests in the northeastern United States. The forest is located on Gardiners Island, New York, and has been in the possession of the Gardiner family since 1639. The forest was sampled using seventy points by the point-centered quarter method to determine species composition and dominance. *Quercus alba* (white oak) and *Q. velutina* (black oak) were co-dominant and comprised approximately two thirds of the trees in the forest. Tree saplings, shrubs, and lianas were sampled in fifty 2 x 4 m quadrats, while tree seedlings were sampled in fifty 1 m^2 quadrats. No *Quercus* spp. seedlings or saplings were observed in the 50 quadrats due to deer browse by an overabundant white-tailed deer population on the island.

Key words: Long Island, New York, old-growth coastal forest.

INTRODUCTION

Bostwick Forest is an old-growth coastal forest comprising more than 400 hectares on Gardiners Island, Suffolk County, New York (41.1° N Lat., 72.1° W Long.), and may be one of the last and largest uncut coastal forests in the northeastern United States (Karpen 2000). The 1343 hectare island is located between the north and south forks of eastern Long Island with Gardiners Bay to the west and Block Island Sound to the east (Fig. 1). The island has been owned by the Gardiner family since 1639 and is the only American real estate that persists from the original grant from the English Crown (R. Gardiner, pers. comm.).

Few botanical and ecological studies have been conducted on Gardiners Island. Early historical reports mentioning Bostwick Forest can be found in the personal journals and writings of members of the Gardiner family (Gardiner 1840, Gardiner 1947). Excerpts from John Lyon Gardiner's journal, 1770-1816, include a description of the size of the oaks: "timber is very various, mostly large white oak suitable for ship timber, some of which are above 4ft in diameter." A compilation of unpublished natural history reports on Gardiners Island has been published by the South Fork Natural History Society (SOFO 1994). No previous study of the species composition of Bostwick Forest has been published. Therefore, the objective of this study was to determine the currently dominant trees in Bostwick Forest.

Gardiners Island has been visited by several botanists during the past 100 years. Burnham and Latham (1914-1925) published an annotated checklist of the flora of Southold

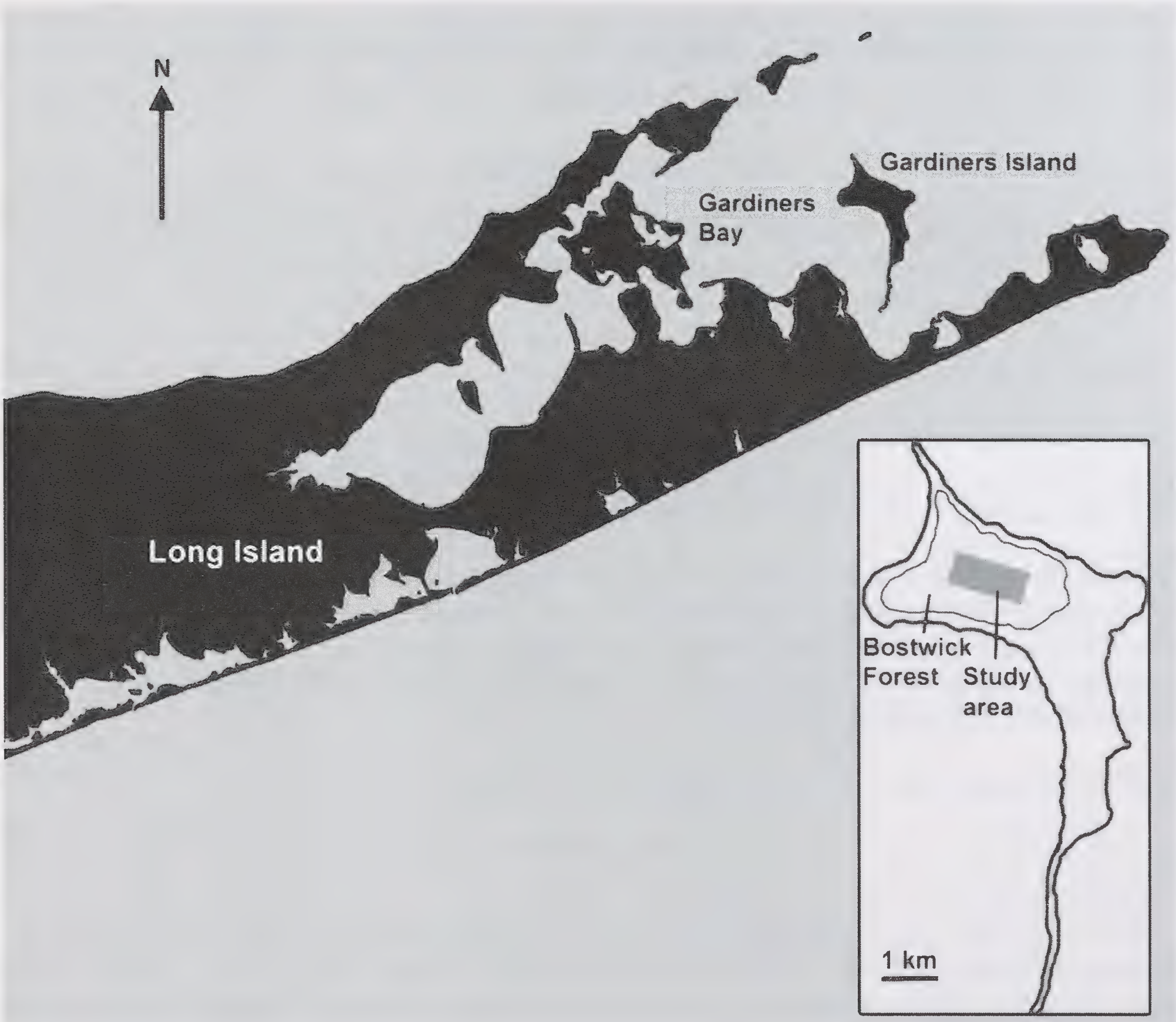

Figure 1. Location of Gardiners Island in relation to Long Island, New York. Inset map: Gardiners Island, showing the approximate boundaries of Bostwick Forest and the area of study.

Township and included 54 vascular plant species from Gardiners Island. Taylor (1922) and Peters (1973) reported on some of the big trees of Bostwick Forest, and Chapman (1903) and Latham (1920, 1969) reported on the island's birds. Hehre (1977) collected 386 spontaneously occurring vascular plant species on Gardiners Island and deposited vouchers in the Hodgdon Herbarium of the University of New Hampshire (NHA). This species number is relatively low, especially when considering nearby and smaller Fishers Island which supports 720 species of vascular plants (Horning 1999). Hehre's (1977) floristic study was conducted during only two and a half summers and did not include systematic collecting in the early spring and autumn (Hehre, pers. comm.).

The vegetation history of Gardiners Island has been summarized by Lamont (1994), based on a review of published and unpublished literature; excerpts from the summary follow. When Lion Gardiner settled the island in 1639, he described it as "covered almost entirely with a growth of large timber. The wood consisted principally of oaks intermixed with walnut and beech." Although much of the island's virgin forest was soon cleared for farming, "one large tract of virgin oak forest escaped the ax and remains to this day

an unparalleled relic of pre-colonial forest in the northeastern United States." This early description of Bostwick Forest was corroborated by Roy Latham who visited the island in 1903 and wrote in his journal about "the great forest" on Gardiners Island: "It is a wonderful sight, and thrills one, to tramp in a forest that has never been touched by the hand of man. At Bostwick is a forest that has never been cut, a forest with trees from three to four hundred years of age." Latham measured the trunk circumferences of some of the largest trees and reported "oaks [*Quercus* spp.] with trunks ten, twelve, fourteen, and even fifteen feet in circumference; dogwood [*Cornus florida*], 4 feet 7 inches; sassafras [*Sassafras albidum*], over 8 feet; red cedar [*Juniperus virginiana*] over 8 feet; wild cherry [*Prunus serotina*], over 9 feet; black birch [*Betula lenta*], 9 feet 7 inches." Norman Taylor, curator at the Brooklyn Botanic Garden, was photographed by Latham in 1919 standing next to a large white oak tree in Bostwick Forest (Figure 2). Nearly 100 years later, Mary Laura Lamont was photographed standing next to a large white oak tree in the forest (Figure 3).

Figure 2. Photograph of Norman Taylor standing next to a large white oak in Bostwick Forest, 1919. Photo by Roy Latham, courtesy of Diana Latham and Jean Held.

Figure 3. Photograph of Mary Laura Lamont standing next to a large white oak in Bostwick Forest, 2003. Photo by Eric Lamont.

Bostwick Forest extends over most of the northern portion of the Gardiners Island (Fig. 1) and is dominated by oaks, notably *Quercus alba* and *Q. velutina*. *Smilax rotundifolia* (bull briar) forms a dense tangle of interconnected stems smothering most other low growing woody species. *Smilax* may have become more abundant in the forest after the hurricane of 1938 (Helmuth 1954).

White-tailed deer (*Odocoileus virginianus*) browsing may play an important role in the lack of regeneration of arborescent vegetation at Bostwick Forest. During our forays to the forest we observed deer and evidence of deer browse on woody vegetation. We also observed several years of copious oak mast, a favorable food of the island's wild turkey (*Meleagris gallopavo*) and white-tailed deer; oak seedlings were quickly eaten by the deer. Mitchell (1997) noted the injurious affect of deer browse on vegetation within and near the vicinity of Harriman State Park, New York. He summarized his observations by stating, "vegetation there has been devastated by deer." Rawinski (2008) presented an overview on the impact of white-tailed deer overabundance in forest ecosystems. These highly prolific animals may have had a profound impact on forest vegetation at Cayuga County, New York, where deer have denuded the forest of its shrubs and saplings. Browsing on woody stems of trees and shrubs is especially prevalent in winter when other sources of food are generally not available (Rawiski 2008). Deer have impacted Hutcheson Memorial Forest,

Rutgers University's long term ecological research station in Middlesex County, New Jersey (Lockwood and Avery 2008). In their annual report of the forest they state, "There was general agreement that the Old Forest had undergone significant changes and now exists in an ecologically degraded state. The cause of this degradation is widely believed to be deer over-abundance."

Hurricanes have played an important role in influencing and impacting the flora and vegetation on the island. One of the earliest mentioned storms was the blow of 1815 that destroyed the Gardiner wind mill built in 1795 from the island's trees. Contradictory information regarding hurricane damage exists for two significant storms of the 20th century, the hurricanes of l938 and 1944. The hurricane of 1938 was the most severe; a gust of 298 kmph (186 mph) was recorded at nearby West Hampton airport. Robert Gardiner (pers. comm.) reported "many of the largest and oldest white oak trees were blown over by the hurricane of 1938," whereas Talmage (l970) noted that "hurricanes have come and gone, but many of the old oaks have withstood nature's gales."

Several plans to develop the island during the 1900's were never implemented. The present owner and Gardiner descendents, the Goelet family, has been quoted as saying they "want to keep the island as a nature preserve" (New York Times, 12 May 1989).

Methods

Bostwick Forest has been visited by Eric Lamont almost every year from 1993 to present. Direct access to the forest for ecological studies was granted by Robert Gardiner. Most visits took place during the month of December when the birds of Bostwick Forest were surveyed for the Audubon Christmas Bird Count; during those visits, observations on the forest were recorded.

After one year of preliminary field observations, we sampled the arborescent vegetation of Bostwick Forest during the summer of 1994. The study site included the center of Bostwick Forest and excluded 30 meters of forest edge. Nomenclature follows Gleason and Cronquist (1991). Trees within Bostwick Forest were sampled by the point-centered quarter (PCQ) method (Cottam and Curtis 1956, Bryant et al. 2004). Trees with a trunk diameter at breast height of 7.62 cm or greater (taken at 1.37 meters above the ground) were sampled at seventy random points. Two hundred and eighty individual trees were measured and form the basis of this study. Relative dominance (total basal area of one species as a percentage of the total basal area of all species) and importance values (sum of the relative frequency, relative number, and relative dominance) were calculated for individual tree species encountered around each point (Table 1). Importance value is a measure of ecological dominance.

Fifty 2 x 4 m quadrats randomly selected in Bostwick Forest were sampled for tree saplings (individuals with a stem diameter less than 7.62 cm), shrubs, and lianas (Table 2). Fifty 1 m^2 quadrats nested within the aforementioned 2 x 4 m quadrats were used to sample tree seedlings. Seven of the largest oak trees in Bostwick Forest were located and trunk circumference at breast height was measured in inches (Table 3). Large trees were located by traversing the entire forest on 15 different site visits.

Results and Discussion

Oaks (*Quercus* spp.) are the most common tree species at Bostwick Forest, composing approximately 75% (211/280 individual trees) of all trees sampled. Four oak species, *Q.*

Table 1. Ecological dominance measured by importance values from the 1994 survey as determined using 70 points and 280 trees in Bostwick Forest. Relative dominance is calculated as the basal area per species divided by the total basal area. Importance values are calculated as relative frequency + relative density + relative dominance x 100.

Species	Relative Dominance	Importance Value
Quercus alba	43.8	106.1
Quercus velutina	36.3	91.6
Carya glabra	6.4	29.9
Quercus rubra	5.8	25.8
Sassafras albidum	2.6	17.6
Quercus coccinea	1.6	9.7
Nyssa sylvatica	0.6	5.6
Betula lenta	0.1	3.7
Prunus serotina	1.0	6.2
Acer rubrum	1.6	3.4
Robinia pseudoacacia	-	0.3

alba, *Q. velutina*, *Q. rubra* L. (red oak), and *Q. coccinea* (scarlet oak), composed 87.5% of the relative dominance and 77.7% of the importance value of all tree species at Bostwick Forest (Table 1). *Quercus alba* is the dominant tree with a relative dominance value of 43.8 and an importance value of 106.1, followed by *Q. velutina* with relative dominance and importance values of 36.3 and 91.6, respectively. *Carya glabra* (pignut hickory) ranks third with a relative dominance value of 6.4 and importance value of 29.9, nearly the same as the fourth taxon, *Q. rubra*, with relative dominance and important values of 5.8 and 25.8, respectively.

Sassafras albidum, the fifth ranked tree in our sample with respect to relative dominance, is a successional species that may have colonized Bostwick Forest when trees were toppled and gaps created during the 1938 and 1944 hurricanes. *Prunus serotina*, another succession species (Bard 1952), also may have become established in the forest during times of natural disturbances. The other seven trees sampled are unimportant (Table 1).

Betula lenta is an unimportant component of Bostwick Forest (Table 1). Scattered individuals of a second birch, *B. alleghaniensis* occur in small numbers in the forest but were not encountered in our sample. *Betula alleghaniensis* is rare at Bostwick Forest and rare on Long Island (LIBS 2011). *Robinia pseudoacacia*, the least important tree in our sample, is not a significant component of the forest; it occurs in the northwest portion of the forest and is a potential threat because of its invasive and clonal nature; once established it can rigorously spread by root sprouts.

No oak tree saplings were observed in our fifty quadrats (Table 2). The liana *Smilax rotundifolia* occurred in all 50 quadrats. Two non-native taxa, *Berberis thunbergii* (barberry) and *Rubus phoenicolasius* (wineberry) occurred in six and four quadrats, respectively. No tree seedlings were observed in our fifty quadrats.

The forest today may not contain as many large diameter trees as observed by Latham and Taylor nearly 100 years ago (Figure 2). The hurricanes of l938 and l944 may have toppled many of the old individuals because few very large trees were observed by us during the present study, although one *Quercus veluntina* with a 1.59 m (5.2 foot) diameter and two additional *Q. velutina* and *Q. alba* attained a DBH of greater than 1.22 m (4 feet) (Table 3).

Table 2. Frequency data for saplings, shrubs and lianas at Bostwick Forest.

Species	Frequency Value
Smilax rotundifolia	100
Berberbis thunbergii	12
Rubus phoenicolasius	8
Sassafras albidum	8
Lindera benzoin	6

Table 3. The circumference of some large black and white oak trees at Bostwick Forest.

Specimen	Species	Circumference (inches)	Locality
1	*Quercus velutina*	196	South of the central interior of the forest
2	*Quercus alba*	165	Northeastern portion of the forest
3	*Quercus velutina*	157	Northeastern portion of the forest
4	*Quercus velutina*	152	South of the central interior of the forest
5	*Quercus alba*	151	Northeastern portion of the forest
6	*Quercus alba*	147	Northeastern portion of the forest
7	*Quercus alba*	145	Northeastern portion of the forest

Another historical impact to the oaks at Bostwick Forest has been gypsy moth infestations coupled with prolonged droughts during the mid-1960s (Penny et al. 1994). Puleston (1994) reported: "In the sixties an infestation of the gypsy moth for several seasons resulted in an almost complete defoliation of the trees of Bostwick Forest and other woodlots. These areas were as bare of leaves as in midwinter. Trees weakened by prior disease or in heavy competition were unable to survive these attacks, and they died out." After the infestation ended, "The healthy trees recovered, with only a possible slight growth retardation to give evidence of the moth attacks." We did not observe many dead standing *Quercus* individuals, nor did we observe many large fallen oaks during our study which may have fallen by 1994 had these oaks been killed by gypsy moth infestations during the mid-1960's. A similar outcome with respect to oak death due to gypsy moth infestation was reported from a mesic oak dominated forest at Greenbrook Sanctuary, New Jersey (Stalter and Serrao 1983).

There are several accounts of old-growth forests on Long Island, New York (Karpen 2000), the piedmont of New Jersey (Bard 1952), and the Adirondacks of New York (Mitchell and Tucker 1994). Mettlers Woods in Somerset County, New Jersey, is an oak dominated, old-growth forest with oaks more than 300 years old; the forest was never logged (Bard 1952) and is presently monitored by research scientists from Rutgers University.

Karpen (2000) catalogued old growth forests on Long Island, New York, and Bostwick Forest, and concluded that the white oak dominated forest on Gardiners Island is, "perhaps one of the largest and most significant old growth forests," on Long Island; it is ten times as large as the second largest old growth forest at Cold Spring Harbor, also a site that is privately owned. The old growth forest at Shu Swamp, Long Island, comprises only 12 ha (Karpen 2000).

In conclusion, Bostwick Forest is dominated by *Q. alba* and *Q. velutina* (Table 1). We observed no oak seedlings or saplings in any of our 50 quadrats which may be a direct result of deer browse. The present oak-dominated forest may persist for 50 to 100 or more years, but with the absence of oak regeneration, the future composition of Bostwick Forest cannot be predicted with certainty.

Since no previous study of the species composition of Bostwick Forest has been published, the objective of this study was to determine the dominant trees in the forest. The data reveals a "snapshot in time" of the forest and provides baseline data for future investigations. Additionally, this oak-dominated coastal forest can now be compared with other similar forests in the region and its ecological significance can be determined. Is Bostwick Forest one of the last and largest uncut coastal forests in the northeastern United States? Have other coastal forests in the region responded similarly to the stresses and impacts of hurricanes, insect infestations, herbivory, climate change, and other biotic and abiotic factors? These questions may now be answered and others might be examined if access to the island is granted to future investigators.

When Robert Gardner passed away in 2004 we were no longer allowed to conduct ecological studies on the island. Although permission has been granted by the current owners to continue surveying the birds of Bostwick Forest, photography is not permitted anywhere on the island and access to certain areas is prohibited. The current owners have been excellent stewards of the island and future ecological studies might be possible, but we have no knowledge of the long-term future plans for the island.

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The authors thank the late Robert David Lion Gardiner, 16th Lord of the Manor, for access to Gardiners Island, transport to, from, and on the island, and hospitality; Diana Latham and Jean Held for supplying Figure 2; and Vincent Ricigliano for preparation of Figure 1. This manuscript was improved thanks to thoughtful comments and suggestions from Alfred E. Schuyler and Stephen M. Young.

Literature Cited

Bard, G. E. 1952. Secondary succession on the piedmont of New Jersey. *Ecological Monographs* 22:195-215.

Bryant, D. M., M. J. Ducey, J. C. Innes, T. D. Lee, R. T. Eckert, and D. J. Zarin. 2004. Forest community analysis and the point-centered quarter method. *Plant Ecology* 175:193-203.

Burnham, S. H. and R. Latham. 1914-1925. The flora of the town of Southold, Long Island and Gardiner's Island. *Torreya* 14:201-225, 229-254. [+supplemental issues: 1917, *Torreya* 17:111-122; 1921, *Torreya* 21:1-11, 28-33; 1923, 1923, *Torreya* 23:3-9, 25-31; 1924, *Torreya* 24: 22-32; 1925, Torreya 25:71-83.].

Chapman, F. M. 1903. An Island Eden. *Bird-Lore* 5:175-182.

Cottam, G. and J. T. Curtis. 1956. The use of distance measures in phytosciological sampling. *Ecology* 37:451-460.

Gardiner, S. D. 1840 [1871, 1973]. *Chronicles of the Town of Easthampton, County of Suffolk, New York*. William Ewers Printers, Sag Harbor. [The original manuscript was written in 1840 by David Gardiner, and rewritten and published by his son David Lion Gardiner in 1871 and reprinted in 1973]

Gardiner, S. D. 1947. Early memories of Gardiners Island. *The East Hampton Star*. East Hampton, NY.

GLEASON, H. A. AND A. CRONQUIST. 1991. *Manual of the Vascular Plants of Northeastern United States and adjacent Canada. 2nd ed.* The New York Botanical Garden, Bronx, NY.

HEHRE, E. J. JR. 1977. The flora of Gardiners Island. *Rhodora* 79:214-239.

HORNING, E. H. 1999. Sleuthing for rare plants on Fishers Island, Suffolk County, New York. *Long Island Botanical Society Newsletter* 9:13-15.

HELMUTH, W. T. The hurricane of 1938 – in retrospect. *Birds of Long Island* 8:225-241.

KARPEN, D. 2000. Old growth forests on Long Island, New York. *Long Island Botanical Society Newsletter* 10:25, 28-29, 34.

LAMONT, E. E. 1994. Vegetation. The way it was and is. pp. 14-16. In *Gardiners Island: Historical and contemporary habitat of the wild and civilized Lords of the Manor*, J. Held (ed.). *South Fork Natural History Newsletter* 6.

LATHAM, R. 1920. Birds of irregular occurrence on Long Island, N.Y. *Auk* 37:306-307.

LATHAM, R. 1969. Notes on barn swallows nesting at Orient and Gardiners Island, New York. *Engelhardtia* 2:12.

LOCKWOOD, J. L. AND J. AVERY. 2008. *Hutcheson Memorial Forest Center 2008 Annual Report.* Rutgers, The State University of New Jersey, School of Environmental and Biological Sciences, New Brunswick.

MITCHELL, R. S. 1997. White-tailed deer: an editorial comment. *New York Flora Association Newsletter*. 8:3.

MITCHELL, R. S. AND G. C. TUCKER. 1994. Flora of an unusually diverse virgin and old-growth forest area in the southern Adirondacks of New York. *Bulletin of the Torrey Botanical Club* 121:76-83.

PENNY, L. 1993. Nature Notes. *The East Hampton Star*. 23 Dec. 1993. East Hampton, NY.

PENNY, L. 1994. Nature Notes. *The East Hampton Star*. 21 July 1994. East Hampton, NY.

PETERS, G. H. 1973. *The trees of Long Island. 2nd ed.* Long Island Horticultural Society, Oyster Bay, NY.

PULESTON, D. 1994. A natural history of anomalies. pp. 8-10. In *Gardiners Island: Historical and contemporary habitat of the wild and civilized Lords of the Manor*, J. Held (ed.). *South Fork Natural History Newsletter* 6.

RAWINSKI, T. J. 2008. *Impacts of white-tailed deer overabundance in forest ecosystems: An overview.* Northeastern Area State and Private Forestry Forest Service, U.S. Department of Agriculture, Newtown Square, PA.

[SOFO] SOUTH FORK NATURAL HISTORY SOCIETY. 1994. *Gardiners Island: Historical and contemporary habitat of the wild and civilized Lords of the Manor*, J. Held (ed.). South Fork Natural History Newsletter, Amagansett, NY.

STALTER, R. AND J. SERRAO. 1983. The impact of defoliation of gypsy moths on the oak forest at Greenbrook Sanctuary, New Jersey. *Bulletin of the Torrey Botanical Club* 110:526-529.

TALMAGE, F. G. 1970. *The Springs in the Old Days*. Steamboat Press, Southampton, NY.

TAYLOR, N. 1922. The forests and some big trees of Long Island. Brooklyn Botanic Garden Leaflets 10, no. 8.

Bartonia No. 67: 84–89, 2015

NEWS AND NOTES

First Record of *Magnolia Grandiflora* L. as a Casual Alien in Pennsylvania.

Magnolia grandiflora L. is a broadleaved evergreen tree native to the southeastern United States (Gleason and Cronquist 1991). A single individual, approximately 1 meter in height, was discovered growing in an abandoned railroad bed on the Reading Viaduct, on a trestle approximately at the intersection of 9th and Green Streets, in Philadelphia County on 11 December 2011. A voucher specimen (Schuyler, Holmes & Baiocchi 9320) was collected and deposited at the herbarium of the Academy of Natural Sciences (PH). *M. grandiflora* is a common landscape plant in the Philadelphia area (pers. obs.), but non-planted populations of the species have not previously been documented in Pennsylvania. No records are mentioned in the *Atlas of Vascular Flora of Pennsylvania* (Rhoads and Klein 1993), and it is not listed in the second edition of *Plants of Pennsylvania* (Rhoads and Block 2007) or earlier floras of Pennsylvania (Noll 1852, Porter 1903), and it is not listed in Britton and Brown (Gleason, 1952). Additionally, the species is not listed in the following floras of Philadelphia: Barton (1818), Keller and Brown (1905), Wherry (1968). The historic range of *M. grandiflora* is the coastal plain along the Atlantic Ocean and Gulf of Mexico in the southeastern United States. Gleason and Cronquist (1991) note the distribution of *M. grandiflora* as "CP [coastal plain] from se. Va. To Fla. And Tex." It is most common south of Virginia, although it has been documented as far north as Maryland (USDA PLANTS, Harvill et al. 1977). Typical habitat in its native range is mesic to hydric sites with minimal disturbance by fire (Gruhn & White 2011). The tree produces fleshy red fruits that are consumed by a variety of birds and small mammals; ingestion by vertebrates serves as the primary method of seed dispersal for the species (Stiles 1980). It is also capable of vegetative propagation (Gardiner 2000).

Naturalized populations of two other historically non-native magnolia species, *M. tripetala* and *M. macrophylla*, have been documented in the Philadelphia area (Rhoads 1994). Like *M. grandiflora*, *M. tripetala* is a southern species that has historically been cultivated as a landscape tree. Cultivation has served as an important driver of naturalization and range expansion for *M. tripetala* by introducing a source of readily dispersed seeds to the region. It is possible that widespread uses of cold-hardy cultivars of M. grandiflora in the landscape and climate change have contributed to localized occurrences of this species as well, and may ultimately result in the establishment of naturalized populations in the region.

Literature Cited

Barton, W. P. C. 1818. *Compendium Florae Philadelphicae, Vol. 2*. M. Carey and Son: Philadelphia, PA. 234 pp.

Gardiner, J. 2000. *Magnolias: A Gardener's Guide*. Timber Press, Portland, OR. 330 pp.

Gleason, H. A. 1952. *The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada, Vol. 2.* Lancaster Press, Lancaster, PA. 656 pp.

Gleason, H. A. and A. Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada, 2nd Edition*. The New York Botanical Garden, New York, NY. 901 pp.

GRUHN, J. A. AND P. S. WHITE. 2011. *Magnolia grandiflora* L. range expansion: a case study in a North Carolina piedmont forest. *Southeastern Naturalist* 10(2):275-288.
HARVILL, A. M., JR., C. E. STEVENS, AND D. M. E. WARE. 1977. *Atlas of the Virginia Flora. Part I: Pteridophytes through Monocotyledons.* Virginia Botanical Associates, Farmville, VA. 59 pp.
KELLER, I. A, AND S. BROWN. 1905. *Handbook of the Flora of Philadelphia and Vicinity*. Philadelphia Botanical Club, Philadelphia, PA. 360 pp.
NOLL, H. R. 1852. *The Botanical Class-Book and Flora of Pennsylvania*. O.N. Worden, Lewisburg, PA. 542 pp.
PORTER, T. C. 1903. *Flora of Pennsylvania*. Ginn & Company, Boston. 362 pp.
RHOADS, A. F. 1994. *Magnolia tripetala* in Pennsylvania. *Bartonia* 58:75-77.
RHOADS, A. F. AND T.A. BLOCK. 2007. *The Plants of Pennsylvania: an Illustrated Manual, 2nd Edition*. University of Pennsylvania Press, Philadelphia, PA. 1056 pp.
RHOADS, A. F. AND W. M. KLEIN, 1993. *The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas.* American Philosophical Society, Philadelphia, PA. 636 pp.
STILES, E. W. 1980. Patterns of fruit presentation and seed dispersal in bird-disseminated woody plants in the eastern deciduous forest. *The American Naturalist* 116(5):670-688.
US DEPARTMENT OF AGRICULTURE, NRCS (USDA). 2009. The PLANTS Database. Available online at http://plants.usda.gov. Accessed 2 April 2013. National Plant Data Center, Baton Rouge, LA.
WHERRY, E. T. 1968. A check-list of the flora of Philadelphia County, Pennsylvania. *Bartonia* 38:1-17.

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APPARENT DISPERSAL OF *REBOULIA HEMISPHAERICA* (AYTONIACEAE) BY SPRINGTAILS

Reboulia hemisphaerica (L.) Raddi is a thallose liverwort distributed in warm and temperate climates worldwide (Boisselier-DuBayle et al. 1998). A tangle of white filaments dangles beneath its spore capsules. The function of these filaments has not been described. I observed the filaments in *R. hemisphaerica* growing in soil between bricks in a walkway in an ally in Center City, Philadelphia. They emerged from the bases of carpocephala and formed loose collections that encircled the setae immediately below the spore capsules. The fibers were breakable and sticky, leaving pieces scattered along the length of the setae.

I watched garden springtails (*Bourletiella hortensis*) crawling up setae and brushing past the filaments on their way up to the carpocephala (Figure 1). In some instances, fragments of filaments stuck to the hexapods as they crossed through the array of fibers. They stuck to the head, thorax, abdomen and legs (Figure 2). After the springtails crawled around the carpocephala and spore capsules, they climbed down with bits of filaments still stuck to them (Figure 3).

I hypothesize these filaments facilitate spore dispersal. Spores released from capsules immediately above the filaments would strike the filaments and adhere to them just as the filaments adhered to the springtails and to the setae. The distribution of *B. hortensis* is cosmopolitan, including all continents (Greenslade and Convey 2012), but filaments could facilitate dispersal by sticking to other arthropods or to vertebrates such as birds or mice, or to wind-borne leaves or detritus. Springtails have not been reported as agents of dispersal of spores of *R. hemisphaerica.* Schuster stated that insect dispersal of liverworts might occur accidentally but never regularly (Schuster 1966), although insects regularly disperse spores of dung moss (Family Splachnaceae) (Marino et al. 2009) and stinkhorn mushrooms (*Mutinus caninus* [Persoon] Fries, Family Phallaceae) (Johnson and Jürgens 2010).

Figure 1. Garden springtail (*Bourletiella hortensis*) on carpocephalum of *Reboulia hemisphaerica*. White filaments dangle below spore capsules and adhere to the seta. This liverwort is growing in soil between brick pavers in an ally in Center City, Philadelphia.

Figure 2. Garden springtail after having picked up fragments of subcapsular filaments stuck to its head, thorax and abdomen.

Figure 3. Fragments of filaments of *R. hemisphaerica* still stuck to garden springtail as it crawls down the liverwort's seta. Fragments are also stuck to the seta.

Subcapsular filaments could have evolved primarily as defensive barriers against small arthropods and secondarily as dispersal media. They are present in other North American thallose liverworts including *Mannia* (Aytoniaceae), *Asterella* (Aytoniaceae) and *Athalamia* (Cleveaceae) (Schuster 1992). Microscopic examination could establish whether subcapsular filaments carry spores.

K.D. Frank

LITERATURE CITED

Boisselier-Dubayle, M. C., J. Lambourdiere and H. Bischler. 1998. Taxa delimitation in *Reboulia* investigated with morphological, cytological, and isozyme markers. *Bryologist* 101(1):61-69.

Greenslade, P. and P. Convey. 2012. Exotic Collembola on subantarctic islands: pathways, origins and biology. *Biological Invasions* 14(2):405-417.

Johnson, S. D. and A. Jürgens. 2010. Convergent evolution of carrion and faecal scent mimicry in fly-pollinated angiosperm flowers and a stinkhorn fungus. *South African Journal of Botany* 76(4):796-807.

Marino, P., R. Raguso, and B. Goffinet. 2009. The ecology and evolution of fly dispersed dung mosses (Family Splachnaceae): manipulating insect behaviour through odour and visual cues. *Symbiosis* 47:61-76.

Schuster, R. M. 1966. *The Hepaticae and Anthocerotae of North America East of the Hundreth Meridian. Vol. I.* Columbia University Press, New York. 802 pp.

Schuster, R. M. 1992. *The Hepaticae and Anthocerotae of North America East of the Hundreth Meridian. Vol. VI.* Field Museum of Natural History, Chicago. 937 pp.

Bartonia No. 67: 90–91, 2015

Bayard Long Award for Botanical Research

The research project must advance our knowledge of plants that occur in the northeastern and mid-Atlantic region of the United States, especially the Philadelphia area. Specifically, the research project must include at least one plant species found in this region, although it can include additional plants not found in the region. (For example, a systematic botany project focusing on a genus with worldwide distribution but with one or more species occurring in the northeastern U.S. would be eligible.) For purposes of this award plants are as traditionally defined to include green plants as well the plant-like organisms: lichens, fungi, and all groups of algae. We especially encourage applications on projects that focus on field work and/or herbarium work.

The award will generally be for $1000. The application deadline is December 15.

Details on applying are available on the club's web site (www.philbotclub.org/long_award.html).

We are pleased to announce that the 2013 Bayard Long Award went to Danny Haelwaters, a graduate student at Harvard University. Mr. Haelwaters' description of his research project:

The first question to bear in mind when thinking about fungal biodiversity and conservation is: How many fungi are really present? Recently an estimate of 5.1 million species was suggested. However, many groups of fungi remain uncharacterized and understudied. One group, the order Laboulbeniales (Fungi, Ascomycota), may be the most intriguing and yet the least studied of all insect-associated fungi.

Laboulbeniales are obligate parasites on invertebrate hosts, including insects, millipedes, and mites. These fungi are microscopic in size, with an average length of about 200–300 µm, ranging from 35 µm to 2 mm, and exhibit different levels of specificity – host specificity (one particular species parasitizes a single or a few host species); position specificity (some species are remarkably adapted to a given position on the host body); and ecological specificity (successful development of the parasite requires not only a suitable host, but also favorable environmental conditions).

Approximately 80% of the Laboulbeniales described thus far are parasitic on beetles (order Coleoptera). With currently only about 2,000 described species[1], the total number of Laboulbeniales associated with arthropod hosts is estimated to be between 15,000 and 75,000 species. Wet tropical areas with high arthropod diversity are likely centers of diversity for Laboulbeniales, most of which awaiting discovery. These parasites have the advantage to be easily observed on the integument of their hosts by trained mycologists

[1]As a side note, the enormous endeavors of one man have been indispensible in the Laboulbeniales research. Between the 1890s and 1931, Prof. Roland Thaxter of Harvard characterized over 1,250 species of the currently 2,000 described species, set up a classification system that is still in use, and condensed his vast knowledge in five monographic volumes that even now are used on a daily basis.

visiting museum collections. This and other features make the Laboulbeniales suited as "model organisms" in the field of parasite biology.

The 2013 Bayard Long Award of the Philadelphia Botanical Club will help support one part of my research. Screening insects at the Academy of Natural Sciences of Drexel University, PA will provide a robust dataset to better understand which species of Laboulbeniales parasitize which groups of hosts. Although many publications with new records and species are being published, the larger distribution patterns of Laboulbeniales have not been summarized in over twenty years.

Bartonia No. 67: 92–122, 2015

2012-2013 FIELD TRIPS

Reports reviewed, formatted, and edited by TED GORDON.

2012 Field Trips

25 February (Saturday): Bartram's Garden, Philadelphia, Pennsylvania. Leaders: David Hewitt and Joel Fry. No report received.

28 April (Sunday): Crow's Nest Preserve, Northwestern Chester County, Pennsylvania. Joint trip with the Delaware Valley Fern and Widflower Society.

This is the second of a series of numerous trips planned over the next several years to Crow's Nest Preserve to develop a comprehensive list of its flora. An account of the first trip on 20 August 2011(see *Bartonia* 66:116-117. 2013) provided an introduction and short history of the site and discussed invasive plants and management practices utilized. Owned by the Natural Lands Trust, the 600-plus acre preserve is located off the southeastern corner of French Creek State Park somewhat south of Pottstown and southwest of Reading. A former farm, the land is currently a general mixture of forest (with oak/hickory being the dominant type), creek-related habitats and marshlands, and a combination of meadows as well as actively plowed grasslands and croplands.

We gathered in the preserve's barn/visitor center for an orientation meeting and then carpooled north on Piersol Road to a point south of Hopewell Road. Here we walked westward through a meadow and woodland to arrive at the preserve's northwest corner, our starting point. We began where we left off in 2011, without conducting any repeated site visits of this semi-wet woodland dominated by maples. This site, while not as rich as the previous year's northeast corner, was still quite productive.

We next proceeded to oak/hickory dominated woods and open areas that are recovering farmland in the north central and northeast corner of the preserve, all of which were south of Hopewell Road.

List of species that occur at sites visited. (Not all plants were observed on this trip.)

Acalypha virginica, Acer rubrum, Achillea millefolium, Agrimonia striata, Agrostis gigantea, Agrostis perennans, Alliaria petiolata, Ambrosia artemisiifolia, Amelanchier arborea, Amphicarpaea bracteata, Andropogon glomeratus, Andropogon virginicus, Anemone (Hepatica) americana, Anthoxanthum odoratum, Apocynum cannabinum, Arisaema triphyllum, Arisaema triphyllum subsp. *pusillum, Aronia arbutifolia, Asclepias purpurascens, A. syriaca, A. tuberosa, Athyrium filix-femina* var. *augustum, Barbarea vulgaris, Berberis thunbergii, Botrychium dissectum, Calystegia sepium, C. spithamaea, Cardamine pensylvanica, Carex bromoides, C. debilis* var. *debilis, C. glaucodea, C. gracillima, C. intumescens, C. laxiculmis, C. prasina, C. radiata, C.* sp., *C. stricta, C. swanii, Carpinus carolinana* subsp. *virginiana, Carya glabra, C. ovata, Celastrus orbiculatus, Cerastium fontanum, Chelone glabra, Chrysosplenium americanum, Cinna arundinacea, Circaea canadensis* subsp. *canadensis, Cirsium discolor, Clematis virginiana, Clinopodium vulgare, Collinsonia canadensis, Commelina communis, Cornus amomum, C. florida, C. racemosa, Crataegus* sp., *Cuscuta gronovii, Cyperus strigosus, Dactylis glomerata, Danthonia spicata,*

Daucus carota, Desmodium paniculatum, D. perplexum, Dichanthelium acuminatum, D. boscii, D. clandestinum, D. dichototum, Digitaria ischaemum, Dioscorea villosa, Diospyros virginiana, Dryopteris carthusiana, Elaeagnus umbellata, Eleocharis tenuis, Elymus hystrix, Endodeca (Aristolochia) serpentaria, Erechtites hieraciifolius, Erigeron annuus, Eupatorium perfoliatum, Eurybia divaricata, Euthamia graminifolia, Eutrochium fistulosum, Fallopia scandens, Fragaria virginiana, Fraxinus pennsylvanica, Galium circaezans, G. mollugo, Gaylussacia baccata, Gentiana andrewsii, Geum canadense, Glyceria striata, Hemerocallis fulva, Hypericum punctatum, Ilex opaca, I. verticillata, Impatiens capensis, Juncus acuminatus, J. biflorus, J. effusus, J. tenuis, Juniperus virginiana, Kummerowia striata, Lactuca canadensis, Leersia oryzoides, L. virginica, Liatris spicata, Ligustrum obtusifolium, Linaria vulgaris, Lindera benzoin, Liriodendron tulipifera, Lobelia inflata, Lonicera japonica, Ludwigia alternifolia, Lycopus uniflorus, L. virginicus, Lysimachia quadrifolia, Maianthemum (Smilacina) racemosum, Medeola virginiana, Microstegium vimineum, Mitchella repens, Morus alba, Muhlenbergia schreberi, Nyssa sylvatica, Oenothera fruticosa subsp. *glauca, Onoclea sensibilis, Osmorhiza* sp., *Osmunda cinnamomea, Oxalis dillenii, Panicum anceps, Parthenocissus quinquefolia, Paspalum laeve, Penstemon digitalis, Perilla frutescens, Persicaria arifolia, P. longiseta, P. maculosa, P. perfoliata, P. punctata, P. sagittata, P. virginiana, Phleum pratense, Physalis heterophylla, Pilea pumila, Pinus strobus, Plantago lanceolata, P. rugelii, Platanus occidentalis, Poa compressa, Polygonatum pubescens, Polygonum aviculare, Polystichum acrostichoides, Potentilla canadensis, P. simplex, Prenanthes altissima, Prunella vulgaris, Prunus serotina, P. virginiana, Pteridium aquilinum, Pycnanthemum tenuifolium, P. virginianum, Quercus alba, Q. montana, Q. palustris, Q. velutina, Ranunculus recurvatus, Rhododendron periclymenoides, Rhus copallina, Rhynchospora capitellata, Rosa carolina, R. multiflora, R. palustris, Rubus allegheniensis, R. flagellaris, R. hispidus, R. occidentalis, R. phoenicolasius, Sambucus canadensis, Sanguinaria canadensis, Sanicula canadensis, Sassafras albidum, Schizachyrium scoparium, Scirpus georgianus, Scutellaria integrifolia, S. lateriflora, Sedum telephium, Setaria parviflora, Smilax glauca, S. rotundifolia, Solanum carolinense, Solidago caesia, S. gigantea, S. juncea, S. patula, S. rugosa, Sorghastrum nutans, Stellaria alsine, S. media, Symphyotrichum laeve* var. *laeve, S. lanceolatum, S. lateriflorum, S. pilosum* var. *pilosum, S. puniceum, Symplocarpus foetidus, Taraxacum officinale, Teucrium canadense, Thelypteris noveboracensis, T. palustris, Toxicodendron radicans, Tridens flavus, Trifolium repens, Ulmus rubra, Uvularia perfoliata, Vaccinium corymbosum, V. pallidum, Vernonia noveboracensis, Veronica americana, V. officinalis, V. serpyllifolia, Viburnum acerifolium, V. dentatum, V. prunifolium, Vincetoxicum nigrum, Viola blanda, V. cucullata, V. sororia, Vitis aestivalis, V. labrusca, V. vulpina.*

Thanks to Jack Holt for providing a list of species known from these sites, to Ted Gordon for assistance in organizing the report, and to Dan Barringer for his assistance at the nature center.

Attendance: 12. **Report by leader: Paul Schubert.**

06 May (Sunday): The Genus *Amelanchier*, Long Pond, Monroe County, Pennsylvania. Leader: Michael Burgess. No report received.

13 May (Sunday): Sourland Mountain Preserve, Somerset County, New Jersey. Joint trip with the Delaware Valley Fern and Wildflower Society.

We hiked up Sourland Mountain, a traprock ridge covered with rocky woods. The intention had been to teach people to identify the typical spring wildflowers. However, winter and

spring had been atypically warm, and many of the spring wildflowers were already past bloom. Fortunately, Sourland Mountain offers some very lovely late spring wildflowers. After noting some alien plants flowering in the lawn, such as bulbous buttercup (*Ranunculus bulbosa*), and passing through the usual zone dominated by alien plants at the edge of the woods (with such aliens as multiflora rose [*Rosa multiflora*] and garlic mustard [*Alliaria petiolata*]), we started to see many nice natives. Spring beauty (*Claytonia virginica*), rue anemone (*Thalictrum thalictroides*), and wild geranium (*Geranium maculatum*) were still in bloom. We admired the pale blue flowers of wild comfrey (*Cynoglossum virginianum*), a threatened plant in New Jersey. Higher up the mountain, we saw violet wood sorrel (*Oxalis violacea*), pennywort (*Obolaria virginica*), and large numbers of showy orchis (*Galearis spectabilis*). A few plants of coral honeysuckle (*Lonicera sempervirens*) were spectacularly in flower.

Other plants in bloom included jack-in-the-pulpit (*Arisaema triphyllum*), squawroot (*Conopholis americana*), sweet cicely (*Osmorhiza claytonii*), common cinquefoil (*Potentilla simplex*), early blue violet (*Viola palmata*), and common blue violet (*V. sororia*). Plants not in bloom included blunt-lobed hepatica (*Hepatica nobilis* var. *obtusa*), cleavers (*Galium aparine*), wild garlic (*Allium canadense*; in bud), mayapple (*Podophyllum peltatum*; in fruit), and round-leaved pyrola (*Pyrola rotundifolia*; in bud). Ferns included interrupted (*Osmunda claytoniana*), Christmas (*Polystichum acrostichoides*), New York (*Thelypteris noveboracensis*), lady (*Athyrium filix-femina*), polypody (*Polypodium* sp.), broad beech (*Phegopteris hexagonoptera*), rattlesnake (*Botrychium virginianum*), sensitive (*Onoclea sensibilis*), maidenhair (*Adiantum pedatum*) and one plant that appeared to be blunt-lobed woodsia (*Woodsia obtusa*), though it was too early for sori to confirm the identification.

In the kingdom Animalia, the most notable finding was a good-sized milk snake sunning itself at trail's edge, seemingly unbothered by the many hikers going past.
Attendance: 10. **Report by leader: Janet Novak.**

19 May (Saturday): Wissahickon Creek, Fairmount Park, Pennsylvania. Leader: Alfred E. Schuyler. No report received.

02 June (Saturday): Wickecheoke Creek Preserve, Hunterton County, New Jersey. Joint trip with the Torrey Botanical Society.

The plan for the day was to follow Wickechoeke Creek upstream making stops along the way. Our first stop was just north of Stockton, the Loop One parking area, along Lower Creek Road about .4 mile northeast from its intersection with Route 519. We explored the edge of a floodplain forest, a nearby field, along the roadside, and finally the creek itself. Here we recorded the following species: *Acer rubrum, A. saccharinum, Adiantum pedatum, Ageratina altissima, Agrimonia* sp., *Alliara petiolata, Allium canadense, A. vineale, Ambrosia artemisiifolia, Amphicarpaea bracteata, Antennaria* sp., *Apocynum cannabinum, Aralia racemosa, Artemisia vulgaris, Arisaema triphyllum, Asplenium trichomanes, Berberis thunbergii, Betula lenta, Boehmeria cylindrica, Cardamine concatenata, Carex vulpinoidea, C. cephalophora, C. radiata, C. amphibola, Carya cordiformis, C. tomentosa, Celtis occidentalis, Coronilla varia, Cryptotaenia canadensis, Cystopteris bulbifera, Dactylis glomerata, Dianthus armeria, Dichanthelium clandestinum, Dioscorea villosa, Erigeron philadelphicus, Eurybia divaricata, Festuca subverticillata, Fraxinus americana, F. pennsylvanica, Galium aparine, G. circaezans, Geum* sp., *Hamamelis virginiana, Hemerocallis fulva, Hesperis matronalis, Heuchera americana, Hydrophyllum virginianum,*

Impatiens capensis, Juglans nigra, Juncus tenuis, Juniperus virginiana, Lindera benzoin, Lonicera morrowii, Microstegium vimineum, Ostrya virginica, Oxalis stricta, Parthenocissus quinquefolia, Pilea pumila, Plantago major, Platanus occidentalis, Poa pratensis, P. trivialis, Podophyllum peltatum, Polygonatum biflorum, Polygonum caespitosum, P. convovulus, P. sagittatum, Polypodium virginianum, Polystichum acrostichoides, Potentilla simplex, Prenanthes sp., *Ranunculus abortivus, R. recurvatus, Rosa multiflora, Rubus occidentalis, Sanguinaria canadensis, Sanicula gregaria, Scutellaria elliptica, Sisyrinchium angustifolium, Solidago canadensis, Solidago flexicaulis, Stellaria media, Symphyotrichum cordifolium, S. lowrieanum, S. undulatum, Taraxacum officinale, Tilia americana, Toxicodendron radicans, Trifolium officinale, Tsuga canadensis, Viburnum acerifolium, V. prunifolium, Viola pubescens, V. soraria, Vitis* sp., and *Zizia aurea.*

We were not able to explore the cliff face in detail due to high water level. A closer look when water levels are lower should be worthwhile. Growing out of the rocks in the creek bed was a member of the Lamiaceae.

Our second stop was the Loop Three parking area on Upper Creek Road. We explored a wet area near the parking lot and then followed the trail through dry fields including a deer-fenced patch which contained an orchid, not in bloom. (It was later identified as *Platanthera lacera* by E. Saulys.) We continued into the woods along the creek. We added almost another 70 species to our list. The additions were *Achillea millefolium, Actaea* sp., *Agrimonia parviflora, Anthoxanthum odoratum, Asclepias incarnata, Barbarea vulgaris, Carpinus caroliniana, Carex blanda, C. complanata* (possibly), *C. scoparia, C. squarrosa, C. stipata, Cirsium arvense, Cornus florida, Cystopteris tenuis, Elaeagnus umbellata, Euonymus* sp., *Eupatorium perfoliatum, Fagus grandifolia, Festuca pratensis, Galium obtusum, Galium* sp., *Geranium maculatum, Glyceria striata, Holcus lanatus, Hypoxis hirsuta, Juncus effusus, Leucanthemum vulgare, Ligustrum* sp., *Lotus corniculatus, Luzula multiflora, Lythrum salicaria, Mentha arvensis, Morella pensylvanica, Myosotis laxa, Onoclea sensibilis, Packera obovata, Penstemon digitalis, Phalaris arundinacea, Phleum pratense, Plantago lanceolata, Platanthera lacera, Polygonatum pubescens, Polygonum arifolium, Populus deltoides, Prunella vulgaris, Pycnanthemum virginianum, Quercus alba, Q. marilandica, Q. rubra, Ranunculus acris, Rosa palustris, Rumex crispus, Sanicula canadensis, Scirpus* sp., *Sedum ternatum, Stellaria graminea, Thalictrum pubescens, Trifolium aureum, T. dubium, T. hybridum, T. pratense*?, *T. repens, Ulmus rubra, Vernonia noveboracensis, Veronica officinalis*, and *Viburnum dentatum.*

Our last stop was 0.7 mile north of the Loop Three parking area. We explored a wet area east of the road and gradually made our way once again to the creek, adding the following species to our list: *Asplenium platyneuron, Bromus pubescens, Callitriche* sp. (*heterophylla*?), *Conopholis americana, Carex crinita, C. festucacea, C. longii, Galinsoga quadriradiata, Glyceria septentrionalis, Hackelia virginiana, Iris versicolor, Symplocarpus foetidus*, and *Verbesina alternifolia.*

Attendance 6. **Report by leader: David Austin.**

09 June (Saturday): Crow's Nest Preserve, Chester County, Pennsylvania. Joint trip with the Delaware Valley Fern and Wildflower Society.

For an introduction and overview of Crow's Nest Preserve owned by the Natural Lands Trust, see paragraph one of the trip report for the 28 April, 2012 visit to this site.

Once again we met at the preserve's visitor center/barn for an orientation and carpooled north along Piersol Road to our starting point south of Hopewell Road in the preserve's northeast corner. Botanizing began here in a sizeable open meadow that featured a variety

of species. Our investigation extended to the south to an area indicated on a map of the preserve as "The Chief's Circle." This northeast meadow produced the folling plants: *Acer rubrum, Achillea millifolium, Alliaria petiolata, Allium vineale, Ambrosia artemisiifolia, Apocynum androsaemifolium, Asclepias syriaca, Carya tomentosa, C. ovata, Celastrus orbiculatus, Celtis occidentalis, Cerastium fontanum, Circium arvense, C. discolor, Clematis virginiana, Dactylis glomeratus, Desmodium canadense, D. canescens, Dianthus armeria, Dichanthelium clandestinum, Erigeron strigosus, Gleditsia tricanthos, Hypericum punctatum, Leucanthemum vulgare, Lonicera japonica, Morus alba, Oxalis stricta, Parthenocissus quinquefolia, Phleum pratense, Polygonum aviculare, Potentilla canadense, Prunus avium, P. serotinum, Rhus copallina, Rosa muliflora, Rubus allegheniensis, R. occidentalis, R. phoenicolasius, Rumex crispus, Sassafras albidum, Solanum carolinense, Solidago candensis, S. juncea, S. rugusa*, (*Solidago* was dominant), *Stellaria graminea, S. media, Symphyotrichum lanceolatum, Toxicodendron radicans, Trifolium campestre, T. pratense, T. repens, Ulmus rubra, Vicia cracca, Viburnum prunifolium*, and *Vitis aestivalis.*

We gradually descended through the meadow by way of a path, passing several patches of crops, to a narrow north/south running stream corridor lined with shrubs and small trees. In the open cropland we added the following species: *Barbarea verna, Calystegia sepium, Circaea canadensis, Euthamia caroliniana, Fragaria virginiana, Fraxinus americana, Galium mollugo, Impatiens capensis, Juncus effusus, Lepidium virginicum, Onoclea sensibilis, Persicaria sagittata* (=*Polygonum sagittatum*), *Physalis heterophylla, Plantago aristata, Silene latifolia, Sambucus canadensis, Sisyrinchium angustifolium, Solanum carolinense, Solidago squarrosa, Symphyotrichum puniceum, Tridens flavus, Verbena urticifolia, Vicia tetrasperma*, and *V. sativa.*

Along the narrow tributary we observed the following new species along with a number of plants already previously seen: *Ambrosia trifida, Arisaema triphyllum, Chelone glabra, Circaea canadensis, Desmodium perplexum, Dryopteris* × *intermedia, Galium lanceolatum, Ligustrum vulgare, Lindera benzoin, Malus coronaria, Microstegium vimineum, Persicaria perfoliata, P. virginiana, Pilea pumila, Quercus palustris, Ranunculus arbortivus, Rosa multiflora, Smilax rotundifolia, Symplocarpus foetidus*, and *Viburnum recognitum.*

On crossing a small bridge over the stream, we came to a meadow with a diverse flora. Here we recorded *Agrimonia parviflora, Alnus glutinosa, Arctium minus, Carex amphibola, Chenopodium album, Cirsium arvense, Cornus amomum, C. florida, Dactylis glomerata, Eutrochium fistulosum* (=*Eupatorium fistulosum*), *Galium obtusum, Glycine max* (soybean), *Juniperus virginiana, Juglans nigra, Lamium amplexicaule, Lysimachia ciliata, Medicago lupulina, Nepeta cataria, Nyssa sylvatica, Phleum pratense, Polygonum sagittatum, Pyrus communis, Rosa carolina, Rubus idaeus, Sorghastrum nutans*, and *Trifolium aureum.*

We followed the tributary to a maple and pin oak dominated wetland associated with the east side of French Creek. Here, in addition to many of the species already observed at other mesic to wet sites, we saw *Alisma triviale, Allium canadense, Alnus serrulata, Amphicarpaea bracteata, Apios americana, Betula nigra, Carex bullata, Carya ovata, Carpinus caroliniana, Cicuta bulbifera, Cryptotaenia canadensis, Dioscorea quaternata, Eupatorium perfoliatum, Hypericum punctatum, Geum canadense, Gratiola neglecta, Laportea canadensis, Ludwigia palustris, Lycopus americanus, Myosotis laxa, Penstemon calycosus, Persicaria arifolia, Podophyllum peltatum, Pseudosasa japonica* (arrow bamboo), *Quercus palustris, Rosa palustris, Ranunculus hispidus, Sagittaria rigida, Sisyrinchium angustifolium, Smilax glauca, Stellaria longifolia, S. pubera, Thalictrum pubescens*, and *Ulmus rubra*. An extensive nearby cattail wetland was left unexplored.

We finished botanizing in two meadows near the preserve's main parking lot on Piersol Road. Here we saw *Actaea racemosa* (=*Cimicifuga racemosa*), *Linaria vulgaris, Rumex altissimus*, and *Silene latifolia.*

Botanizing was led by Chris Hoess and Janet Novak. Thanks to Ted Gordon for help with organizing the report.

Attendance: 8. **Report by leader: Paul Schubert.**

10-14 June (Sunday-Thursday): Slippery Rock University and Presque Isle, Pennsylvania. Annual Joint Field Meeting of the Northeast Section of the Botanical Society of America, the Torrey Botanical Society, and the Philadelphia Botanical Club.

After dinner at the university on Sunday evening, Scott Shriver presented a fine program on orchids.

On Monday we consolidated into a few cars to visit Jennings Environmental Education Center in Butler County. Here we walked the Prairie Ecosystem Trail, an excellent limestone habitat, and recorded the following herbs: *Coreopsis tripteris*, tall tickseed, *Eupatorium fistulosum*, joe-pie-weed, *Helianthus giganteus*, swamp sunflower, *Heliopsis helianthoides,* ox-eye, *Heuchera americana*, common alum-root, *Krigia biflora*, two-flowered Cynthia, *Lysimachia quadrifolia*, whorled loosestrife, *Maianthemum racemosum*, false Solomon's seal, *Polemonium reptans*, spreading Jacob's-ladder, *Sanguinaria canadensis,* bloodroot, *Thalictrum pubescens*, tall meadow-rue, *Thaspium trifoliatum*, smooth meadow-parsnip, *Veronicastrum virginicum*, culver's-root, and *Zizia aptera*, heart-leaf golden-alexanders. We noted several imposing specimens (nearly 3 m tall) of *Swertia caroliniensis* (*), American columbo, in the Gentianaceae. The flowers were pale yellowish-green with purple dots in terminal and axillary paniculate inflorescences. Also quite frequent, although far from blooming, was *Liatris spicata*, dense blazing star. Widely scattered were *Physocarpus opulifolius*, ninebark, *Prunus virginiana*, choke cherry, *Quercus imbricaria*, shingle oak, and *Spiraea alba*, meadowsweet. Among the sedges were *Carex bushii, C. cristatella, C. granularis, C. radiata,* and *C. squarrosa*. After lunch, we explored a marsh associated with the Allegheny River at the foot of a slope at Emlenton. In the flood plain we recorded *Carex emoryi, C. grayi, C. trichocarpa, Deschampsia cespitosa, tufted hairgrass* (*), *Phalaris arundinacea*, reed canary grass, *Salix exigua* subsp. *interior*, sandbar willow, *Liriodendron tulipifera*, tuliptree, *Platanus occidentalis*, sycamore, *Eupatorium perfoliatum*, boneset, *Hypericum ellipticum*, pale St. John's-wort, *Justicia americana*, water-willow, *Lysimachia nummularia*, moneywort, *Myosotis scorpioides*, forget-me-not, *Rumex orbiculatus*, great water-dock, *R. verticillatus*, swamp dock, *Verbesina alternifolia*, wingstem, and the beautiful > 1 m tall *Baptisia australis*, blue false indigo. Rain curtailed our botanizing. The evening program was on Thomas Nuttall's early botanical journeys by Steve Grund, today's field leader.

On Tuesday we travelled by bus to Presque Isle State Park on Lake Erie, an incredibly diverse landscape rich in species of concern. Dr. James Bissell, Director of Conservation and Curator of Botany at the Cleveland Museum of Natural History, met us at the park. We looked at beaches, dunes, thickets, old lagoons, sub-climax forests, and restored patches whose native vegetation had returned after tedious removal of oppressive invasives. Among the species observed were *Alisma triviale,* water-plantain, *Amelanchier laevis,* smooth shadbush, *Ammophila breviligulata,* American beachgrass, *Artemisia campestris* subsp. *caudata*, beach wormwood (*), *Carex pellita, C. striata, C. viridula, Cyperus diandrus, Dulichium arundinaceum, Eleocharis intermedia* (*), *E. obtusa, E. palustris, Cephalanthus occidentalis*, buttonbush, a stunning display of *Geranium bicknellii,* Bicknell's geranium (*),

Hypericum majus, Canadian St. John's-wort (*), *Ilex verticillata*, winterberry, *Iris virginica*, southern blue flag (*), *Juncus acuminatus, J. brachycephalus, Lithospermum canescens*, hoary puccoon (*), *Ludwigia palustris*, water-purslane, *Myriophyllum heterophyllum*, broad-leaved water-milfoil (*), large numbers of *Platanthera flava* var. *herbiola*, tubercled rein-orchis and *P. lacera*, ragged fringed-orchid, *Populus deltoides*, eastern cottonwood, *Potamogeton praelongus*, white-stemmed pondweed (*), *P. richardsonii*, red-head pondweed, *Quercus palustris*, pin oak, *Schizachyrium scoparium* var. *littorale*, seaside bluestem (*), *Schoenoplectus fluviatilis* {= *Scirpus fluviatilis; Bolboschoenus fluviatilis*; river bulrush (*)}, *Toxicodendron rydbergii*, western poison ivy (*), lacking aerial rootlets, *Typha angustifolia*, narrow-leaved cat-tail, *Viburnum recognitum*, northern arrowwood, and *Vitis riparia*, frost grape. The evening program was on Dr. Otto Jennings and prairies by Bonnie Issac.

On Wednesday we visited glacial terrain south of the Campus: Slippery Rock Gorge Natural Area, Moraine State Park, and Mc Connells Mill State Park. Among the species we observed were the ferns *Athyrium filix-femina, Botrychium dissectum, Cystopteris protrusa, Dennstaedtia punctilobula, Dryopteris intermedia, Asplenium trichomanes, Onoclea sensibilis, Polystichum acrostichoides, Thelypteris noveboracensis;* the grasses *Agrostis hyemalis, Anthoxanthum odoratum, Brachyelytrum erectum, Bromus inermis, Calamagrostis canadensis, Glyceria melicaria, G. striata, Holcus lanatus, Milium effusum, Dichanthelium latifolium* (= *Panicum latifolium*), *Poa trivialis*; the sedges *Carex albicans, C. albursina, C. blanda, C. bromoides, C. gracillima, C. granularis, C. grayi, C. gynandra, C. platyphylla, C. swanii, C. vulpinoidea*; the rushes *Juncus tenuis, Luzula acuminata, L. multiflora*; and the trees *Acer rubrum, A. saccharum, Cornus sericea, Magnolia acuminata, Prunus serotina, Quercus rubra,* the vine *Toxicodendron radicans*; and such herbs as *Amphicarpaea bracteata*, hog-peanut, *Caulophyllum thalictroides*, blue cohosh, *Heracleum lanatum*, cow-parsnip, *Hydrangea arborescens*, wild hydrangea, *Lysimachia quadrifolia*, whorled loosestrife, *Oxalis montana*, mountain wood-sorrel, *Podophyllum peltatum*, mayapple, *Polemonium reptans*, spreading Jacob's-ladder, *Sambucus racemosa*, red-berried elder, *Sanicula odorata* (= *S. gregaria*), yellow-flowered sanicle, *Solidago patula*, spreading goldenrod, *Veratrum viride*, false hellebore, and *Viola labradorica* (= *V. conspersa*), American dog violet.

Our evening banquet was followed by Mary Joy Haywood's program, "Wildflowers of Pennsylvania."

Thanks go to Mary Paoli for assistance with this report. An asterisk (*) indicates a plant listed as endangered or threatened in PA.

Attendance: 26. **Chairperson: Mary Paoli & assistant to the chair, Nan Williams. Leaders: Jim Bissel, Steve Grund, and Bonnie Issac. Report by Ted Gordon.**

16 June (Saturday): Whitesbog section of Brendan Byrne State Forest (formerly Lebanon State Forest), Burlington and Ocean Counties, New Jersey.

Along the drainage ditches bordering the parking lot across from the old company store at the historic cranberry/blueberry village of Whitesbog, we noted *Carex lurida, Juncus acuminatus, J. debilis, J. effusus, Andropogon virginicus, Rhexia mariana*, and *R. virginica*. Just to the west of the parking lot in a Japanese honeysuckle-entangled poplar/birch grove amid the foundation and rubble of a former cranberry packing house, we relocated specimens of *Asplenium platyneuron* and *Botrychium virginianum* (= *Botrypus virginianus*), but were unable to find again specimens of *Botrychium dissectum, B. matricariifolium*, and the peculiar *Ophioglossum pusillum* (=*O. vulgatum* var. *pseudopodum*), perhaps as a result of

competing vegetation and canopy closure. This complex of ferns is not at all unusual among crumbling foundations of iron forges, furnaces, mills, and other lime-bearing substrates throughout disturbed areas in the Pines.

After a short walk to the east, we arrived at the garden associated with "Suningive," the home of Elizabeth White from 1923 until her death in 1954. Here we admired a number of Miss White's plantings, especially ericaceous shrubs. Several imposing specimens of *Rhododendron maximum* (great laurel) served as a reminder that this mountain shrub is also indigenous to isolated spots in the Pine Barrens, with the nearest native occurrence in a cedar/hardwood swamp at Atsion. Also present were specimens of four southern evergreen shrubs, among them *Rhododendron catawbiense* (mountain rosebay; frequent), *Leucothoe fontanesiana* (=*L. axillaris* var. *editorum*; mountain dog-hobble; abundant), *Pieris floribunda* (mountain fetterbush; scarce), *P. japonica* (Japanese andromeda; scarce) with leaves tapering at the base, and the native *Kalmia latifolia* (mountain laurel). We saw a small plant of *Gaylussacia brachycera* (dwarf huckleberry), recently planted to replace several vigorous specimens removed by vandals many years ago. The initial introduction of several specimens at Whitesbog has, on occasions, led to the erroneous conclusion that this evergreen, eglandular huckleberry is native to the state. Significant, as well, was the presence of three tall trees of southern affinity in the Ericaceae, *Oxydendrum arboreum* (sourwood). While a most surprising discovery of an ericaceous shrub native to Japan, *Enkianthus campanulatus* (redvein enkianthus), was made in 2010 by M. Szutarski, during removal of bull briar and thick undergrowth in the wooded area near the west end of the garden.

Related to our native pyxie, two southern evergreen herbs in the Diapensiaceae, *Galax urceolata* (= *G. aphylla* misapplied; beetleweed) and *Shortia galacifolia* (Oconee bells), continue to flourish in the garden. In contrast, the rare native *Lygodium palmatum* (climbing fern), once a prolific population transplanted here from New Lisbon, has been reduced to a few fronds.

Our next stop was a moist, open, roadside habitat bordering Lakehurst Road (Route 530) in the vicinity of Pole Branch near Route 70. Here late season mowing or infrequent prescribed burning of the road shoulders has helped to sustain an array of pioneer species including *Calamovilfa brevipilis, Platanthera blephariglottis, Juncus biflorus, Scleria triglomerata, Asclepias amplexicaulis, Lilium superbum, Prenanthes autumnalis, Lachnanthes caroliniana**, *Polygala lutea**, *Calopogon tuberosus**, *Pyxidanthera barbulata**, and *Leiophyllum buxifolium**.

After eating lunch in the village, we drove east on a sandy cranberry bog dike bordering Big Tank reservoir to see two small stations of *Stylisma pickeringii* var. *pickeringii* in bloom. Nearby grew *Rubus cuneifolius* and *Minuartia caroliniana*. Steadily closing in as a result of succession, an old "turfcut" (created by sod removal for dike repair) near Job's Swamp reservoir still harbored the following array of pioneer species: *Drosera filiformis, Utricularia striata, U. subulata*, and the five species above marked with an asterisk (*).

Our final stop was Gaunt's Brook corridor near the Fort Dix boundary to the north. Along a reservoir dam was *Symphyotrichum novi-belgii, Toxicodendron vernix, Carex canescens* var. *disjuncta*, and in the water, *Eriocaulon compressum, E. decangulare, Orontium aquaticum*, and *Potamogeton confervoides*. Within an adjacent cedar/hardwood swamp on sphagnous hummocks of *Carex exilis* and in ore-stained coves where bog iron was mined for Hanover Furnace, we noted *Juncus caesariensis, Schizaea pusilla, Sarracenia purpurea, Drosera filiformis, D. intermedia, D. rotundifolia, Pogonia ophioglossoides, Gaylussacia dumosa, Lophiola aurea*, and a substantial pocket of the endangered lily *Narthecium*

americanum, at or near its northern limit of range. An earlier visit in June resulted in finding three *Arethusa bulbosa* in flower. (The latter two taxa were first observed at this site in June 1971 by T. Gordon.) Thanks to Donna McBride and Tom Besellman for contributing to the list of species observed.
Attendance: 11. **Report by leaders: Ted Gordon and Mark Szutarski.**

24 June (Sunday): North Branch Preserve of the Rancocas Conservancy, New Lisbon vicinity, Pemberton Township, Burlington County, New Jersey.

North Branch Preserve is a 240 acre forested tract owned by the Rancocas Conservancy, a non-profit land preservation organization. Adjacent to Burlington County College, the preserve straddles the Rancocas Creek west of the Pemberton By-Pass, aka Route 530 Spur. The land also straddles the boundary between the Inner and Outer Coastal Plains, providing a suite of habitats for a unique mix of species. The site was once an active farm and also a former home of the Blueberry and Cranberry Experimental Station. In 2011 Joe Arsenault prepared a report of the preserve that recorded approximately 300 vascular species. This trip was designed to add new species names to that list.

The trip began at the preserve's parking lot next to the By-Pass bridge, where we followed a trail west. We examined the sides of a dirt road that followed the south bank of Rancocas Creek. A mature mixed hardwood forest canopy of willow oak, southern red oak, scarlet oak, tulip poplar, and sweet gum occupied the land between the trail and the sandy creek bank. *Lygodium palmatum, Lonicera sempervirens, Smilax rotundifolia*, and *Dioscorea villosa* were vines intertwined with the river's edge ubiquitous *Clethra alnifolia* shrub understory. Herbaceous species were limited to areas of open sandy loam. *Carex pensylvanica, C. nigromarginata, C. albicans* var. *emmonsii, Chasmanthium laxum*, the diminutive shrub *Gaultheria procumbens*, and the common treeclubmoss *Dendrolycopodium obscurum* (= *Lycopodium obscurum*) formed a ground cover where gaps in the shrub layer permitted. Rubus hispidus was also found in this habitat. South of the trail was an even aged sweet gum forest. *Vaccinium corymbosum, Viburnum dentatum, Viburnun nudum* var. *nudum,* and *Sambucus nigra* were scattered under the sweet gum with *Lonicera japonica, Onoclea sensibilis, Rosa multiflora, Juncus effusus*, and *Osmunda cinnamomea*. The trail led to a huge hybrid oak, identified as *Quercus* × *rudkinii* (believed to be a cross between *Q. phellos* and *Q. marilandica*). This specimen had a 47" diameter and a well formed canopy with a spread of more than 50'. Surrounding this specimen were many seedlings, indicating the tree was fertile. Two additional colonies of *Lygodium palmatum* were discovered at the western terminus of this dirt path, each also associated with the creek and its tributary stream banks. Located at the trail terminus was a manmade pond surrounded by a ring of leather-leaf, *Chamaedaphne calyculata*. The pond's edge and open water supported *Carex striata, Juncus militaris, Myriophyllum humile, Hypericum mutilum, Eleocharis robbinsii,* and *Oldenlandia uniflora*.

After a brief lunch the trip explored an immature woodland north of the creek but south of Browns Mills-Pemberton Road. This habitat was a series of eroded terraces that led to the creek's northern bank. We saw a recovering woodland of white pine, red cedar, red maple, and sweet gum form a discontinuous canopy covering a thicket of *Ilex verticillata, Viburnum dentatum, Cornus amomum, Lindera benzoin*, and *Vaccinium corymbosum*. Remnants of the site's former use as test plots for both cultivated blueberries and cranberries were still visible. Cinnamon and royal ferns were mixed with *Dendrolycopodium obscurum, Lycopodium clavatum, Lonicera japonica,* and *Tipularia discolor* on irregularly drained terraces to the creek bank. Upland sandy ridges between lower swales supported southern

red oak, red hickory, mockernut hickory, sand hickory, American beech, and many seedlings of *Quercus* × *rudkinii*. In this vicinity, the Rancocas Creek floodplain supported yet another station of climbing fern. This colony coverered a few thousand square feet and was easily the largest found on the Rancocas Conservancy's land. Regarding this vicinity, long time club members may remember an intensive effort in the early 1980s by the conservation community and the Pinelands Commission that led to the realignment of the Pemberton by-pass road in the vicinity of Burlington County College to avoid the destruction of a substantial segment of this fern population.
Attendance: 17. **Report by leader: Joe Arsenault.**

07 July (Saturday): Basic Fern Identification, Cedars House, Fairmount Park, northwest Philadelphia, Pennsylvania. Joint workshop with the Delaware Valley Fern and Wildflower Society.

Indoors at Cedars House, we covered basic fern terminology, and then went over distinguishing characteristics for 20 common ferns of the area: *Adiantum pedatum* (maidenhair fern), *Asplenium platyneuron* (ebony spleenwort), *Athyrium filix-femina* (lady fern), *Dennstaedtia punctilobula* (hayscented fern), *Deparia acrostichoides* (silvery glade fern), *Dryopteris carthusiana* (spinulose woodfern), *D. intermedia* (intermediate woodfern), *D. marginalis* (marginal woodfern), *Matteuccia struthiopteris* (ostrich fern), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *O. claytoniana* (interrupted fern), *O. regalis* (royal fern), *Phegopteris connectilis* (long beech fern), *P. hexagonoptera* (broad beech fern), *Polypodium appalachianum, P. virginianum* (polypody fern), *Polystichum acrostichoides* (Christmas fern), *Pteridium aquilinum* (bracken), *Thelypteris noveboracensis* (New York fern), and *T. palustris* (marsh fern). For most of these species, we had fresh fronds to study, thanks to the generosity of Fern and Wildflower Society member Jack Schieber, who grows them in his garden. Because of extreme heat on July 7, we postponed the field session to August 4. This session consisted of a 2.5 mile walk in Philadelphia's Fairmount Park along Forbidden Drive south of Valley Green Inn, returning by the Orange Trail on the opposite side of the Wissahickon Creek. The walk yielded 17 of the species we had studied, lacking only *Osmunda claytoniana, Phegopteris connectilis*, and *Pteridium aquilinum.*
Registrants: 10. **Report by leader: Janet Novak.**

15 July (Sunday): Botany by Bike, Brendan T. Byrne State Forest, Burlington County, New Jersey.
Leader: Russell Juelg. No report received.

28 July (Saturday): Quaker Bridge Vicinity, Wharton State Forest, Burlington County, New Jersey. Joint trip with the Torrey Botanical Society.

The group assembled outside of the Ranger Station at Atsion and carpooled into Quaker Bridge in order to minimize car traffic, parking issues, and time spent walking. The first site we visited was located just south of Quaker Bridge, a well-known wet savannah along the Batsto River. This site contained many noteworthy species including *Schizaea pusilla, Asclepias rubra, Narthecium americanum*, and *Pogonia ophioglossoides*. Under the shade of *Chamaecyparis thyoides*, several *Platanthera clavellata* were located as well as *Smilax laurifolia*. The group then continued on foot to a second site, located about ¾ mile further downstream along the Batsto River. This open grassland was dominated by *Cladium*

mariscoides and *Juncus canadensis*, yet harbored many other great species. Observed were *Juncus caesariensis, Eupatorium leucolepis, Juncus militaris, Muhlenbergia torreyana,* and *Rhynchospora chalarocephala*. Near the river we came upon some open mudflats containing *Juncus pelocarpus, Utricularia purpurea, U. striata, Proserpinaca pectinata, Eleocharis obtusa, E. microcarpa, Rhynchospora alba*, and *Sclerolepis uniflora*. Growing in the flowing water of the river were *Eriocaulon aquaticum* and *Scirpus subterminalis*. Hot, tired but satisfied, the group returned to Atsion shortly after 3.
Attendance: 13. **Leaders: Uli Lorimer and Heather Liljengren. Report by the former.**

25 August (Saturday): Bartram's Garden, Philadelphia, Pennsylvania. Joint trip with the Delaware Valley Fern and Wildflower Society.
Leaders: Joel Frey and David Hewitt. No report received.

08 September (Saturday): Burden Hill Forest, Alloway and Quinton Townships, Salem County, New Jersey.

During the past decade, the leaders have conducted more than a dozen field trips to the Burden Hill Forest of Salem County in an effort to develop a comprehensive list of the flora and a much needed description of the region. We have made several repeat visits during different times of the year as well as lone explorations of new segments. Botanizing commenced at our usual meeting site, Peck's Corner, and from there we walked to our first stop, the preserved land of dry sandy old fields and young woodlands bordering Old Stage Coach Road. Here we added several new species: *Daucus carota, Vinca minor, Cichorium intybus, Chondrilla juncea, Sporobolus vaginiflorus, Cenchrus longispinus, Euphorbia maculata, E. nutans*, and *Ipomoea hederacea.*

We next visited a familiar, always productive, high voltage power line cut north of Spillway Drive within the Thundergut Wildlife Management Area. Our goal was not to get bogged down in areas we scrutinized in the past but to inspect a swath of unique seeps and wet pockets located among the towers on terraces north of Deep Run pond. Recently, a maintenance crew removed much of the woody vegetation here, exposing the herbaceous understory. We also examined two isolated depression located some 200 meters east of the power line cut. These "new" habitats yielded *Eupatorium maculatum, Impatiens capensis, Ipomoea hederacea, Sicyos angulatus, Drosera intermedia, Lobelia nuttallii, Petrorhagia prolifera, Strophostyles helvola, Triadenum virginicum, Nymphaea odorata, Brasenia schreberi, Platanus occidentalis, Fallopia scandens* (=*Polygonum scandens*), *Polygonella articulata, Verbena urticifolia, Kyllinga gracillima, Aristida longespica, Eragrostis pectinacea*, and *Xyris difformis*. The trip added 27 species, bringing the total list of vascular plants for the Burden Hill Forest to 522.

Our final stop was west of Woodmere beyond the borders of Burden Hill Forest. Here forest gave way to open plowed fields and pastures. North of Holgate Road, on a private parcel of land peppered with isolated, seasonally flooded depressions, we noted an imposing population and a range extension of the endangered Virginia buttonweed, *Diodia virginiana* (discovered here by Arsenault in 2011). Prior to 2006, when we observed an occurrence of this rare member of the Rubiaceae on a road shoulder in Manchester Township, Ocean County, this species appeared to be confined to Cape May County. The Lower Alloways Township occurrence was associated with *Juncus acuminatus, J. effusus, Polygonum hydropiperoides, Proserpinaca palustris*, and *Rhexia virginica.*
Attendance: 11. **Report by leaders: Ted Gordon and Joe Arsenault.**

22 September (Saturday): Aquatic Plant Primer, Hamilton-Trenton-Bordentown Marsh, Mercer County, New Jersey.

At the edge of Spring Lake we saw a variety of common wetland species including *Peltandra virginica* and *Hibiscus moscheutos*, as well as state rare species, *Wolffiella gladiata* and *Heteranthera multiflora*. The afternoon site was a tidal freshwater wetland near the Hamilton Water Treatment facility. The marsh there was dominated by a mix of annual and perennial species, e.g., *Amaranthus cannabinus, Bidens laevis, Impatiens capensis, Pilea pumila, Polygonum punctatum, Zizania aquatica, Leersia oryzoides, Peltandra virginica,* and *Sagittaria latifolia. Phalaris arundinacea* was common along the stream channel. A small swamp area had *Alnus incana, Acer rubrum, Viburnum dentatum*, a mix of the herbaceous annuals and perennials, and on the hummocks occasional herbaceous species, such as *Chelone glabra, Symphyotrichum puniceum*, and *Viola* spp.
Participants: 12. **Report by leader: Mary Leck.**

30 September (Sunday): Warren Grove Gunnery Range, Warren Grove, Burlington and Ocean Counties, New Jersey.

Our group met just inside the bombing range gates at the Drexel University Lab of Pinelands Research Quonset hut. Here we were given a safety briefing before we made our way onto the range itself. Our first stop on the bombing range was the runway, a long strip of asphalt and sand that is used in military training operations. Along this runway we encountered the federally threatened *Rhynchospora knieskernii* (Knieskern's beaked rush). The *R. knieskernii* population here is being monitored by Marilyn Sobel as part of her Ph.D. dissertation research. We then explored an open field adjacent to the runway that hosts the largest known population of *Gentiana autumnalis* (Pine Barren gentian) in New Jersey. The *G. autumnalis* population encountered in this field is currently being monitored by Ryan Rebozo as part of his Ph.D. dissertation research. As part of investigating the role of land management on *G. autumnalis*, portions of this field had been mowed, disked and burned in February 2012. Based on average quadrat density extrapolated over the areal size of the runway field, the gentian population of this field was estimated to be 25,956 (+/- 5,268; 95% confidence interval) individuals for 2012. In this runway field we once again found *Rhynchospora knieskernii*, along with four other species of *Rhynchospora* (*alba, capitellata, cephalantha*, and *torreyana*). In this field we also encountered several species of ericaceaous shrubs including *Gaylussacia baccata* and *Vaccinium angustifolium*, annual graminoids such as *Scleria minor, Juncus debilis*, and *Andropogon virginicus* as well as herbaceous perennials, including *Hypericum canadense, Eurybia compacta*, and *Solidago puberula*. We then headed north on the bombing range to explore a bog savannah named "Big Bog". Here we walked through an open savannah surrounded by mature *Chamaecyparis thyoides*. As we first entered the bog we noticed patches of *Narthecium americanum* post flowering. *N. americanum* is scattered throughout the bog and is also monitored by the Drexel Lab of Pinelands Research. Carnivorous plants such as *Sarracenia purpurea, Drosera rotundifolia, D. intermedia, D. filiformis, Utricularia cornuta, U. subulata, U. geminiscapa, U. juncea*, and *U. striata* were abundant in the savannah. Other species encountered in the bog savannah included *Scleria muehlenbergii, Triantha racemosa, Xyris torta, X. difformis*, five species of *Carex* (*collinsii, exilis, folliculata, livida*, and *striata*), and *Pogonia ophioglossoides.* One hundred and forty eight species were identified on this field trip.

List of species encountered

Acer rubrum var. *trilobum, Amelanchier canadensis, Amphicarpum amphicarpon, Andropogon glomeratus, A. virginicus, Arctostaphylos uva-ursi, Minuartia caroliniana, Aristida* sp., *Aronia arbutifolia, Ascelpias rubra*, Bartonia paniculata, B. virginica, Betula populifolia, Calamovilfa brevipilis*, Carex collinsii, C. exilis, C. folliculata, C. livida, C. pensylvanica, C. striata, C. tonsa, Catalpa speciosa* (non native), *Cetraria arenaria, Chamaecyparis thyoides, Chamaedaphne calycaluta, Cladium mariscoides, Clethra alnifolia, Comptonia peregrina, Cuscuta* sp., *Cyperus dentatus, C. retrorsus, Danthonia epilis, Dichanthelium ensifolium, D.* sp., *Diodia teres, Drosera filiformis, D. intermedia, D. rotundifolia, Dulichium arundinaceum, Eleocharis flavescens* var. *olivacea* (= *E. olivacea*), *E. microcarpa, E. robbinsii, E. tuberculosa, Epigaea repens, Eriocaulon aquaticum, E. decangulare, Eriophorum virginicum, Eubotrys racemosa, Eurybia compacta, Euthamia* sp., *Gaultheria procumbens, Gaylussacia baccata, G. dumosa, G. frondosa, Gentiana autumnalis*, Helianthemum canadense, Hudsonia ericoides, Hypericum canadense, H. densiflorum, H. gentianoides, H. stans, Ilex glabra, I. opaca, Iris prismatica, Juncus caesariensis*, J. canadensis, J. debilis, J. effusus, J. pelocarpus, J. tenuis, Kalmia angustifolia, K. latifolia, Lachnanthes caroliniana, Lechea minor, L. pulchella, Leiophyllum buxifolium, Lobelia nuttallii, Lophiola aurea, Lycopodiella alopecuroides, L. caroliniana, Lyonia mariana, Magnolia virginiana, Melampyrum lineare, Morella caroliniensis, Muhlenbergia torreyana*, Narthecium americanum*, Nymphaea odorata, Nyssa sylvatica, Oclemena nemoralis, Osmunda cinnamomea, O. regalis, Panicum rigidulum, P. spretum, P. virgatum, Pinus echinata, P. rigida, Pogonia ophioglossoides, Polygala brevifolia, P. cruciata, P. lutea, P. nuttallii, Proserpinaca pectinata, Pteridium aquilinum, Pyxidanthera barbulata, Quercus ilicifolia, Q. marilandica, Rhexia virginica, Rhododendron viscosum, Rhynchospora alba, R. capitellata, R. cephalantha*, R. gracilenta, R. knieskernii*, R. torreyana, Rubus hispidus, Sabatia difformis, Sarracenia purpurea, Schizachyrium scoparium, Scirpus cyperinus, Scleria minor*, S. muehlenbergii, S. pauciflora*, Smilax glauca, S. rotundifolia, Solidago puberula, Sphagnum bartlettianum, S. cuspidatum, S. cyclophyllum*, S. flavicomans, S. macrophyllum*, S. pylaesii, Triadenum virginicum, Triantha racemosa*, Trichostema dichotomum, Utricularia cornuta, U. geminiscapa, U. juncea, U. striata, U. subulata, Vaccinium angustifolium, V. caesariense, V. corymbosum, V. macrocarpon, V. pallidum, Xerophyllum asphodeloides, Xyris difformis, and X. torta*. An asterisk (*) indicates a New Jersey rare or a Pinelands protected species. Thanks to Terry Schmidt for maintaining a species list and to Walt Bien for identifying *Sphagnum* species.

Report by leaders: Marilyn Sobel and Ryan Rebozo.

01 December (Saturday): Fulshaw Craeg Preserve, Montgomery County, Pennsylvanica. Joint trip with the Delaware Valley Fern and Wildflower Society.

Fulshaw Craeg, a preserve owned by the Natural Lands Trust, is known for moist meadows with a diverse and rather showy set of plants. The diversity was evident even in December. In one moist meadow, we saw *Chamaelirium luteum* (fairy wand) in fruit. We found only a single fruiting stem, which we hoped was due to other stems being flattened by the fall weather, and not because it was the only plant that set seed this year. Other plants seen with fruit or fruit remnants in the meadows included *Asclepias purpurascens* and *A. viridiflora* (purple and green milkweeds), *Cirsium muticum* (swamp thistle), *Gentiana andrewsii* (bottle gentian), *Heliopsis helianthoides* (ox eye), *Lilium canadense* (Canada lily), *Phlox maculata* (wild sweet William), *Solidago speciosa* (showy goldenrod), and *Veronicastrum virginicum*

(culver's root). *Zizia aurea* (golden alexanders) was easily recognizable because its leaves were still green. In woods along the creek were a few plants of *Dirca palustris* (leatherwood), which was easily recognized from its thick twigs. During the growing season, in contrast, *Dirca* can be hard to find because its leaves look similar to those of the much more abundant *Lindera benzoin*. In a marshy meadow, we saw abundant *Chelone glabra* (turtlehead), as well as *Physocarpus opulifolius* (ninebark) and *Rosa palustris* (swamp rose). In ditches at the edge of the meadows, we saw some obligate wetlands plants, including *Mimulus alatus* (winged monkeyflower), *Penthorum sedoides* (ditch stonecrop), an *Alisma* sp. (water plantain), and the tips of next year's *Symplocarpus foetidus* (skunk cabbage). In the final meadow we saw the distinctive three-winged fruits of a *Dioscorea* sp. (wild yam).
Attendance: 24. **Report by leader: Janet Novak.**

2013 Field Trips

17 March (Sunday): Mid-Atlantic Lichens, Blackbird State Forest, New Castle County, Delaware.

While waiting for participants to arrive, those present expressed a desire for the club to hold more field trips on the Delmarva, noting the close proximity to Philadelphia and the presence of many interesting habitats. Despite the cold, a group of members, including many of those from northern Delaware and Maryland, partook in an opportunity to lichenize two areas within Blackbird State Forest on the northern portion of the Delmarva Peninsula in Delaware. The areas we visited were suggested by Robert Naczi of the New York Botanical Garden because they contained a reasonably diverse vascular plant flora which we hoped would correlate to a good diversity of lichens. Thankfully we were not disappointed as the day resulted in new reports for Delaware as well as several species that we did not expect to be present due to pollution (e.g., the fruticose *Usnea pensylvanica*) and extensive historical disturbance (the cyanolichen *Leptogium juniperium*).

First we examined the lichens of a small riparian corridor in the Tybout Tract along Blackbird Forest Road. The site was forested with mature mixed hardwoods (*Acer, Carya, Carpinus, Fraxinus* and *Ilex*), and the abundance of lichens in the riparian corridor compared to the adjacent uplands was noticeable to all. We also noticed the conspicuous differences between the many foliose lichens growing on branches and trunks fallen from the canopy compared to those that were present on the bases and lower trunks of the trees.

Second we examined the forest along the edge of a pond in the Cypress Complex Tract along Saw Mill Road. Before even entering the forest we noted the presence of *Gyalideopsis moodyae*, a new record for Delaware, on organic matter in the parking area. The sight of the group on their hands knees staring at the ground was likely a sight for passers-by. The profusion of lichens growing on light-exposed trees along the pond margins was quite noticeable, including extensive colonies of the foliose *Crespoa crozalsiana*. Presumably the abundance and diversity of lichens along the margin of the pond is due to a combination of constant humidity and exposure to light. A list of the lichens we encountered follows (collection numbers in italics are those of the leader; vouchers are deposited in the herbarium of The New York Botanical Garden). This fieldtrip was part of the National Science Foundation funded inventory of the lichens of the Mid-Atlantic Coastal Plain being conducted by the leader and his colleague Richard Harris.

Tybout Tract – *Anaptychia palmulata* (Michx.) Vain. (35839), *Anisomeridium polypori* (Ellis & Everh.) M.E. Barr (35759), *Arthonia caesia* (Flot.) Körber (35801), *A.* cf. *quintaria*

Nyl. (35761, sterile), *Bacidia schweinitzii* (Fr. ex Tuck.) A. Schneid. (35771, brown form), *Biatora longispora* (Degel.) Lendemer & Printzen (35773), *Candelariella* cf. *xanthostigmoides* (Müll. Arg.) R.W. Rodgers (35794, sterile), *Cladonia ramulosa* (With.) J.R. Laundon (35788), *C. ochrochlora* Flörke (35789), *Dictyocatenulata alba* Finley & E.F. Morris (35775), *Flavoparmelia caperata* (L.) Hale (35799), *Graphis scripta* (L.) Ach. (35766), *Lepraria caesiella* R.C. Harris (35782), *L. hodkinsoniana* Lendemer (35791), *Myelochroa aurulenta* (Tuck.) Elix & Hale (35777), *Nadvornikia sorediata* R.C. Harris (35790), *Opegrapha corticola* Coppins & P. James (35792), *Parmotrema hypotropum* (Nyl.) Hale (35803), *Pertusaria paratuberculifera* (35800), *P. pustulata* (Ach.) Duby (35767), *Phaeocalicium polyporaeum* (Nyl.) Tibell (35781), *Phaeophyscia pusilloides* (Zahlbr.) Essl. (35769), *P. rubropulchra* (Degel.) Essl. (35776), *Physcia americana* G. Merr. (35780), P. *millegrana* Degel. (35796), *P. pumilior* R.C. Harris (35779), *Pseudosagedia cestrensis* (Tuck.) R.C. Harris (35783), *Punctelia caseana* Lendemer & B.P. Hodk. (35798), *P. missouriensis* G. Wilh. & Ladd (35786), *P. rudecta* (Ach.) Krog (35802), *Pyrenula subelliptica* (Tuck.) R.C. Harris (35770), *Pyrrhospora varians* (Ach.) R.C. Harris (35760), *Pyxine sorediata* (Ach.) Mont. (35778), *P. subcinerea* Stirt. (35774). *Rinodina maculans* Müll. Arg. (35765), *Usnea pensylvanica* Motyka (35838), *Variolaria pustulata* (Brodo & Culb.) Lendemer et al. (35772).

Cypress Complex – *Amandinea polyspora* (Willey) Lay & May (35823), *Anisomeridium polypori* (Ellis & Everh.) M.E. Barr (35811), *Arthonia caesia* (Flot.) Körber (35825), *Arthonia* cf. *quintaria* Nyl. (35824, sterile), *Bacidia schweinitzii* (Fr. ex Tuck.) A. Schneid. (35809), *Biatora longispora* (Degel.) Lendemer & Printzen (35832), *B. pontica* Printzen & Tonsberg (35810), *Buellia stillingiana* J. Steiner (35815), *Crespoa crozalsiana* (de Lesd.) Lendemer & Hodkinson (35813), *Flavoparmelia caperata* (L.) Hale (35805), *Graphis scripta* (L.) Ach. (35829), *Gyalideopsis moodyae* Lendemer & Lücking (35840), *Hypotrachyna horrescens* (Taylor) Krog & Swinsc. (35821), *H. minarum* (Vain.) Krog & Swinsc. (35821-A), *Lecanora strobilina* (Spreng.) Kieff. (35804), *Lepraria caesiella* R.C. Harris (35807), *L. finkii* (de Lesd.) R.C. Harris (35808), *L. hodkinsoniana* Lendemer (35833), *Leptogium juniperinum* Tuck. (35837), *Myelochroa aurulenta* (Tuck.) Elix & Hale (35834), *Nadvornikia sorediata* R.C. Harris (35835), *Parmotrema hypotropum* (Nyl.) Hale (35820), *P. reticulatum* (Ach.) M. Choisy (35819), *Pertusaria pustulata* (Ach.) Duby (35830), *Physcia millegrana* Degel. (35828), *Pseudosagedia cestrensis* (Tuck.) R.C. Harris (35817), *Punctelia rudecta* (Ach.) Krog (35831), *Pyrrhospora varians* (Ach.) R.C. Harris (35827), *Ramonia microspora* Vězda (35812).

Report by leader: James C. Lendemer.

13 April (Saturday): Shenk's Ferry, Lancaster County, Pennsylvania. Joint trip with the Delaware Valley Fern and Wildflower Society.

On a beautiful April day we visited this southwest facing glen along the Susquehanna River that is famous for its displays of up to 70 species of native spring wildflowers. The 50 acre tract is owned by Pennsylvania Power and Light Company, and is operated as a wildflower preserve. Flowering was slightly behind schedule, but still we observed many of the expected species, including *Mertensia virginica, Erythronium albidum, E. americanum, Caulophyllum thalictroides, Dicentra canadensis, D. cucullaria*, and many others. This is an excellent spot for the novice to identify spring ephemerals, to socialize with other botanists, as there is a widely available list of species, dense populations and an easily walkable trail. Attendance: 17, including 7 PBC and 7 DVFWS members.

Report by leader: David Lauer.

21 April (Sunday): Trillium Species Collection, Clarksboro, Gloucester County, New Jersey. Joint trip with the Delaware Valley Fern and Wildflower Society.

We visited "Fern Hill," the 7.5 acre home and grounds of longtime member John Gyer to view his extensive collection and propagations of the genus *Trillium*. This has been John's home and garden since the 1960s. It includes a wide variety of native herbaceous plants in addition to the trilliums, in a variety of habitats including mature woodland, moist stream banks and open fields. John has extensive knowledge of *Trillium* biology and shared much of that with us as it pertained to pollination and propagation. He also graciously provided the group with refreshments.

Attendance: 21, including 11 PBC and 8 DVFWS members. **Report by leader: David Lauer.**

27 April (Saturday): Introduction to Spring Flora, Crosswicks Creek, Mercer County, New Jersey.

On our way to the Crosswicks Creek floodplain, we first walked through mowed fields of Bordentown's Northern Community Park. In this sunny, sandy area, we noted a number of introduced species, such as a stork's-bill (*Erodium cicutarium*), a tiny forget-me-not (*Myosotis stricta*), and a rather attractive small pansy (*Viola arvensis*), the latter two species already identified on previous visits. In the wooded bluff above the floodplain, we saw abundant mayapple (*Podophyllum peltatum*) in bloom. In the floodplain itself was a nice display of wildflowers. Both spring beauty (*Claytonia virginica*) and wood anemone (*Anemone quinquefolia*) put on a more impressive display than most of us had seen before. Downy yellow violet (*Viola pubescens*) was also abundant in bloom. Virginia bluebells (*Mertensia virginica*), although less numerous, were also quite lovely. Several plants had pure pink flowers. Nearby was one of the least showy of spring flowers: false mermaidweed (*Floerkea proserpinacoides*), with miniscule dull white flowers. Bulbous cress (*Cardamine bulbosa*) was just coming into bloom. Trout lilies (*Erythronium americanum*) were mostly past bloom, but Mark Szutarski found a few flowers at their peak.

After the field trip officially ended, Mark Szutarski led some of us to a trail starting from the canoe launch where Groveville Road crosses the creek. Here we saw a larger population of bluebells, as well as Dutchman's breeches (*Dicentra cucullaria*) in bloom.

Attendance: 7. **Report by leader: Janet Novak.**

11 May (Saturday): Franklin Parker Preserve, Chatsworth, Burlington County, New Jersey.

Leader: Russell Juelg. No report received.

18 May (Saturday): Bartram's Garden and American Society of Botanical Artists Exhibition, Philadelphia, Pennsylvania.

Leaders: Joel Frey and Robin Jess. No report received.

25 May (Saturday): Crow's Nest Preserve, Chester County, Pennsylvania. Joint trip with Delaware Valley Fern and Wildflower Society.

For an introduction and overview of Crow's Nest Preserve, see paragraph one of the trip report for the 28 April, 2012 visit to this preserve owned by the Natural Lands Trust.

We met at the visitor center/barn for an initial orientation and carpooled north along Piersol Road to our starting point south of Hopewell Road to a new destination of the preserve's northeast corner. We botanized a roadside and the slopes of a densely vegetated

hill. At the base of the hill ran an asphalt road bordered by a wide array of plant life. The hill was within the top half of the preserve and on the lower east side of Crows Nest's top half somewhat above Harmonyville Road. In more exact terms, this site was located right across the road from the preserve's parking lot and somewhat lower down, the preserve manager's barn/visitor center and house.

Roadside Plants across from the Piersol Road parking lot

Acer rubrum, Amelanchier laevis, Amorpha fruticosa, Anemone virginiana, Antennaria parlinii, Asclepias tuberosa, Asplenium platyneuron, Betula lenta, Botrychium virginianum, Carya tomentosa, C. cordiformis, Castanea dentata, Comandra umbellata, Cornus florida, C. alternifolia, Clematis virginiana, Dactylis glomeratus, Dryopteris marginalis, Erigeron philadelphicus, Fagus grandifolia, Fragaria virginiana, Galium circaezans, Gaylussacia baccata, Hamamelis virginiana, Heuchera americana, Hieracium venosum, Ilex opaca, I. verticillata, Krigia biflora, Lepidium campestre, Leucanthemum vulgare, Liriodendron tulipifera, Lysimachia quadrifolia, Narcissus pseudonarcissus, Nyssa sylvatica, Plantago lanceolata, Polygonatum biflorum, Polystichum acrostichoides, Populus grandidentata, Potentilla simplex, Prunella laciniata, Quercus alba, Q. montana, Q. velutina, Ranunculus abortivus, Rhododendron periclymenoides, Rubus occidentalis, Salix cordata, Sanguinaria canadensis, Sassafras albidum, Symphyotrichum cordifolium, Taraxacum officinale, Vaccinium corymbosum, V. pallidum, V. stamineum, Vernonia gigantea, Veronica officinalis, Viburnum acerifolium, V. dentatum, and *V. prunifolium*.

Slope Plants within 100 feet of the road

Amelanchier arborea, Aralia nudicaulis, Berberis thunbergii, Betula lenta, Carpinus caroliniana, Carya cordiformis, Castanea dentata (frequent), *Chimaphila maculata, Crataegus chrysocarpa, Dennstaedtia punctilobula, Dioscorea villosa, Epigaea repens, Geranium carolinianum, Goodyera pubescens, Hamamelis virginiana, Hieracium gronovii, H. venosum, Hypoxis hirsuta, Ilex opaca, Kalmia latifolia, Lysimachia quadrifolia, Maianthemum canadense, Melampyrum lineare, Mitchella repens, Nyssa sylvatica, Osmunda claytoniana, Polypodium virginianum, Prunus serotina, Pteridium aquilinum, Quercus montana, Q. rubra, Rhododendron periclymenoides, Sassafras albidum, Smilax rotundifolia,* and *Vaccinium stamineum*. On the slope behind the garage and in the vicinity of the preserve manager's house were *Amelanchier laevis, Anthoxanthum aristatum, Cunila origanoides, Cypripedium acaule* (a patch of 5 plants), *Daucus carota, Desmodium perplexum, Ilex laevigata, Juniperus virginiana, Persicaria virginiana, Ranunculus bulbosus, Sanicula marilandica, Sassafras albidum, Syringa vulgaris, Toxicodendron radicans,* and *Ulmus procera.*

Plants at Mid Slope to the Top

Commelina communis, Desmodium cuspidatum, Isotria verticillata, Medeola virginiana, Microstegium vimineum, Monotropa uniflora, Osmunda claytoniana (distinct clumps), *Polygonatum pubescens, Rosa multiflora, Smilax glauca, Uvularia perfoliata*, and *Viburnum*

acerifolium. Many of the species seen at lower elevation were seen here as well. It was unusual not to see any asters.

Thanks to Janet Novak for identifying the bulk of the plants.

Attendance: 6. **Report by leader: Paul Schubert.**

09-13 June (Sunday-Thursday): Southern Adirondack Mountains, Warrensburg, New York. Annual Joint Field meeting of the Northeast Section of the Botanical Society of America, the Torrey Botanical Society, and the Philadelphia Botanical Club.

The first day we visited two locations along the upper Hudson River in meadows kept open by the build up of frazil ice over the winter. We found at least one species that had not been previously recorded, *Orobanche uniflora*, one-flowered cancer root, and perhaps several new graminoids. The second day we visited the Pack Demonstration Forest of the State of New York. We were rewarded with sightings of *Goodyera repens* and *Botrychium matricariifolium* and several species of *Equisetum* and graminoids. In the afternoon we visited a site rich in *Platanthera flava*. The third day we explored a forested trail along the shore of Lake George.

Evening programs included a discussion of work being conducted by the NY Flora Association, a talk on why the Ice Meadows have such an unusual and diverse flora, a photo presentation showing the flora and fauna of the area, and a photo tour of the Native Plant Collection of the Geo Landis Arboretum in Esperance.

Attendance: 44. **Report by Chairperson: Edward Miller.**

16 June: Glen Onoko, Carbon County, Pennsylvania. Joint trip with the Delaware Valley Fern and Wildflower Society.

The trip began at the Glen Onoko entrance station to Lehigh Gorge State Park and ascended the trail up Glen Onoko (on State Game Lands 141). The gorge was heavily shaded by *Tsuga canadensis*, Eastern hemlock, with abundant *Dryopteris intermedia*, intermediate wood fern. Rare species of note were sporophylls of *Huperzia porophila*, rock firmoss, below Chameleon Falls and *Streptopus amplexifolius*, twisted-stalk, in late bloom at Cave Falls and the cascades below. High water prevented us from examining a much smaller colony of *H. porophila* and abundant epipetric *Drosera rotundifolia*, round-leaved sundew, at Glen Onoko Falls. A small specimen of the latter was seen on the near side of the falls. After eating lunch at the head of the gorge, we descended the side of Broad Mountain by another trail to the northeast through a dry, acid deciduous forest.

Species observed (budding or flowering material indicated with *) were *Acer pensylvanicum* (fruiting), *A. platanoides, A. rubrum, A. saccharum, A. spicatum, Ageratina altissima, Aralia racemosa, Arisaema triphyllum, Asplenium montanum* (fertile), *A. platyneuron, Aralia nudicaulis**, *Aronia arbutifolia, Betula alleghaniensis, B. lenta, B. populifolia, Brachyelytrum erectum, Castanea dentata, Chelone glabra, Chimaphila maculata**, *Comptonia peregrina, Convallaria majus* (around ruins of old hotel), *Corydalis sempervirens**, *Cypripedium acaule, Danthonia spicata, Dendrolycopodium obscurum, Dennstaedtia punctilobula, Deschampsia flexuosa, Deutzia* cf. *scabra**, *Dichanthelium* sp., *Diervilla lonicera**, *Drosera rotundifolia, Dryopteris intermedia, D. marginalis, Epigaea repens, Epipactis helleborine**, *Eurybia divaricata, Gaultheria procumbens**, *Gaylussacia frondosa* (fruiting), *Hamamelis virginiana, Huperzia porophila, Hydrangea arborescens**, *Ilex montana, Kalmia angustifolia**, *K. latifolia**, *Lysimachia quadrifolia, Maianthemum racemosum* (=*Smilacina racemosa*), *Melampyrum lineare, Microstegium vimineum, Nyssa*

sylvatica, Oclemena acuminata, Osmundastrum cinnamomeum, Oxalis sp., *Parthenocissus quinquefolia, Phegopteris connectilis, Pinus rigida, P. strobus, Polygonatum biflorum, P. pubescens**, *Polypodium* sp., *Potentilla simplex, Prunus serotina, Pteridium aquilinum, Pyrola elliptica**, *Quercus alba, Q. ilicifolia, Q. montana, Rhamnus frangula**, *Rhododendron maximum**, *Rhus typhina, Rubus* sp., *Sambucus racemosa* (fruiting), *Sassafras albidum, Smilax glauca, S. rotundifolia, Solidago* sp. (*S. arguta*?), *S. caesia, Sorbus* sp., *Streptopus amplexifolius* (fruiting), *Tilia americana, Toxicodendron radicans**, *Tsuga canadensis, Vaccinium angustifolium, V. pallidum, V. stamineum* (fruiting), *Viburnum acerifolium* (fruiting), *Viola* sp.* (*V. blanda* or *V. macloskeyi*), *V. sagittata* (fruiting), *Vitis* sp.
Ample thanks to Janet Novak for maintaining a species list.
Attendance: about 10. **Report by leader: Chris Hoess.**

29 June (Saturday): Cedar Swamp, Flood Gates, Repaupo Station, Gloucester County, New Jersey. Joint trip with the Torrey Botanical Society.

The trip began at the terminus of Flood Gate Road at the confluence of Repaupo Creek with the Delaware River. Many non-native invasive plants were observed along the disturbed open uplands and wetlands adjacent to the road, including *Acorus calamus, Amorpha fruticosa* (fr.), *Artemisia vulgaris, Celastrus orbiculatus, Eragrostis curvula, Humulus japonicus, Iris pseudacorus* (fr.), *Lonicera japonica, Lythrum salicaria, Melilotus alba, Microstegium vimineum, Morus alba, Phragmites australis* subsp. *australis, Polygonum perfoliatum*, and *Rosa multiflora* (fr.). The less frequently encountered non-native *Polygonum orientale* was also noted. Areas where the invasives were not dominant allowed for the examination of native flora. In the uplands *Amphicarpaea bracteata, Apios americana, Apocynum cannabinum* (fl.), *Nuttallanthus* (*Linaria*) *canadensis* (fr.), and *Phytolacca americana* (fl.) were observed. In the wetlands, *Asclepias incarnata* (bud), *Carex crinita* (fr.), *C. lurida* (fr.), *Cephalanthus occidentalis* (bud), *Ilex verticillata* (fr.), *Lysimachia terrestris* (fl.), *Onoclea sensibilis, Osmunda cinnamomea, O. regalis, Polygonum arifolium, P. sagittatum*, and *Rosa palustris* (fl.) were noted. The group then hiked along a dirt road that headed toward Cedar Swamp. In the open, moist-to-dry, sandy areas adjacent to the road, the group saw *Polygala mariana* (rare in NJ), *P. nuttallii*, and *P. sanguinea* all in bloom. Other species noted in bloom were *Crotolaria sagitallis, Diodia teres, Hypericum stragulum, Ipomoea pandurata, Pycnanthemum tenuifolium, P. virginianum, Rhexia mariana*, and *Solanum carolinense*. Other species noted in these open uplands and wetlands included *Betula populifolia, Carex swanii, C. tonsa, C. vulpinoidea, Danthonia spicata, Dennstaedtia punctilobula, Desmodium paniculatum, Dichanthelium scoparium, Digitaria* (*Leptoloma*) *cognata, Diospyros virginiana, Dryopteris intermedia, Erechtites hieracifolia, Eupatorium album, E. hyssopifolium, Fimbristylis autumnalis, Hypericum gentianoides, Lespedeza capitata, Pteridium aquilinum, Solidago gigantea, S. rugosa, Thelypteris noveboracensis,* and *T. palustris*. The group then walked through a forested wetland. In a flooded area near the road, the group puzzled over a population of *Heteranthera*, finally determining the material to represent *H. multiflora*. In a nearby freshwater tidal marsh the following were noted: *Asclepias incarnata, Betula nigra, Cornus amomum* (fl.), *Dioscorea villosa* (bud), *Eupatorium dubium, E. perfoliatum, Mikania scandens, Polygonum punctatum, Pontederia cordata* (fl.), *Rhododendron viscosum* (fl.), *Sambucus canadensis* (fl.), *Sanicula canadensis* (fl.), *Spiraea tomentosa, Symplocarpus foetidus, Typha angustifolia*, and *Zizania aquatica.* Exceptionally large material of Peltandra virginica was observed, some specimens over five feet tall. The group's last stop was along a powerline cut adjacent to Cedar Swamp. The

original purpose of the trip was to explore this swamp, a historical botanical site, including the pockets of *Chamaecyparis thyoides* that still remain. However, the recent extensive rains left the swamp severely flooded and unable to be explored.
Special thanks to Janet Novak for maintaining a species list.
Attendance: 21. **Report by leaders: Uli Lorimer and Gerry Moore.**

30 June (Sunday): Calico Ridge, Cutt's Pump, and Buck Run Savannas above Martha Furnace, Wharton State Forest , Burlington County, New Jersey.

At Harrisville Lake on Route 679, we consolidated into 4-wheel drive vehicles and drove to the site of Martha Furnace. Our mission was to visit habitats that sustained *Narthecium americanum*, bog asphodel, and *Triantha racemosa* (=*Tofieldia racemosa*), viscid asphodel, and record their associated flora. Upstream of the old furnace dam, we explored a mineral-poor fen comprised of sphagnum hummocks, quaking bogs, and savannah segments. This habitat of unique species diversity occupied the former pond bed at the foot of lower Calico Ridge. Recent excess rainfall restricted access somewhat as we searched unsuccessfully for an elusive occurrence of *Rhynchospora oligantha*, feather-bristled beaksedge (not seen here in recent years), severely declining specimens of false or viscid asphodel, and the diminutive *Utricularia resupinata,* reversed bladderwort. However, we saw several yellow flowering spikes of the state endangered bog asphodel, currently known only from the Pine Barrens of New Jersey and fronds of *Schizaea pusilla*, the rare curly grass fern. We compiled a substantial list of associated species in a habitat that continues to maintain its vitality.

List of species observed at Calico Ridge

Acer rubrum var. *trilobum**, *Ilex glabra**, *Oclemena nemoralis**, *Clethra alnifolia**, *Chamaecyparis thyoides**, *Carex exilis**, *Cladium mariscoides, Eleocharis tenuis, Rhynchospora fusca, Drosera filiformis**, *D. intermedia**, *D. rotundifolia**, *Chamaecyparis thyoides**, *Chamaedaphne calyculata**, *Gaultheria procumbens, Gaylussacia dumosa**, *G. frondosa, Kalmia angustifolia**, *K. latifolia, Lyonia mariana**, *Rhododendron viscosum, Vaccinium corymbosum**, *V. macrocarpon**, *Eriocaulon compressum**, *E. decangulare**, *Sabatia difformis**, *Triadenum virginicum, Utricularia cornuta**, *U. striata, Lophiola aurea**, *Narthecium americanum**, *Lycopodiella alopecuroides, Nymphaea odorata, Calopogon tuberosus**, *Pogonia ophioglossoides**, *Pinus rigida**, *Andropogon glomeratus**, *A. virginicus**, *Danthonia epilis**, *Dichanthelium dichotomum* var. *ensifolium**, *Sarracenia purpurea**, *Schizaea pusilla**, *Smilax rotundifolia**, *Sphagnum compactum, S. flavicomans, S. molle, S. pulchrum**, *S. pylaesii, S. tenerum, Vaccinium macrocarpon**, and *Xyris difformis.* {A plant followed by an asterisk (*) indicates the plant was seen at each of the three major sites visited.}

Further north along the Oswego River adjacent to Cutt's Pump, the ruins of a structure that housed a lift-pump related to the cranberry industry, we investigated another mineral-poor, savannah-like fen that may have been created or impacted by turf removal. Periodic, extended flooding of this shallow, relatively open basin and browsing by deer of Atlantic white cedar saplings and some shrubs (e.g., sweet pepperbush) have helped to maintain conditions suitable for sustaining the pioneer herbs that occupy this site. Shallow inundation of this sphagnous, *Carex exilis* hummock-hollow zone did not prevent us from successfully botanizing here. Striking displays of bog asphodel, rose pogonia, *Pogonia ophioglossoides,*

and golden crest, *Lophiola aurea*, a couple of fine pockets of flowering viscid asphodel, along with extensive patches of curly grass fern and Carolina clubmoss, *Pseudolycopodiella caroliniana*, were among the highlights.

List of species observed at Cutt's Pump

All plants above followed by an asterisk (*) were also observed at this site. Additional species seen were *Orontium aquaticum, Eupatorium pilosum, Vaccinium fuscatum* (=*V. atrococcum*), *Triantha racemosa, Rhexia virginica, Sphagnum bartlettianum, S. tenerum, Lycopodiella alopecuroides, Dichanthelium dichotomum* var. *lucidum, Muhlenbergia uniflora, Panicum virgatum, Eleocharis tuberculosa, Rhynchospora fusca*, and *Rubus hispidus*.

Our final stop further north brought us to a small bridge over Buck Run at the Old Martha Road where we explored another mineral-poor fen with both quaking bog and savannah aspects bordering the south side of this feeder stream of the Oswego. A June 22, 1986 fire that had swept through the entire wetland complex (as well as the upland) during a severe dry spell resulted in long-term negative impacts on the upland border of the bog mat. Here the fire consumed an open stand of cedar saplings that harbored an array of pioneer species: pink and white rose pogonias, white fringed orchids, pipeworts, sabatias, and curly grass ferns. To date, this once productive ecotone remains lost and has been replaced by a dense three-meter thicket of ericaceous and other shrubs entangled by bull briars. It was with difficulty that we penetrated this dense thicket at several points to obtain views of stunning iron-ore stained pools laden with enormous pitcher plant goblets associated with bladderworts, sundews, orchids, and other herbs. Several participants gained access to the interior on hummocks that projected above the floodwaters. Their reward was seeing some of the more notable species: a single lingering flowering specimen of dragon mouth orchid, two early-appearing culms of pine barren boneset, numerous sticky culms of viscid asphodel in bud and in flower, yellow spikes of bog asphodel, culms of sheathed panicgrass, *Dichanthelium scabriusculum*, scabrous stems of New Jersey rush, and a new occurrence of a few plants of pine barren bellwort in a dense thicket near the base of a slope. Few places in the Pine Barrens can equal the diversity and beauty of the quaking bogs that prevail here.

List of species observed at Buck Run

All species marked with an asterisk (*) above, were also observed here. Additional species found were *Orontium aquaticum, Thelypteris simulata, Eupatorium resinosum, Woodwardia virginica, Carex atlantica, C. collinsii, C. folliculata, C. livida, C. striata, Eleocharis tuberculosa, Gaylussacia frondosa, Lyonia ligustrina, Rhododendron viscosum, Iris versicolor, Juncus caesariensis, Triantha racemosa*, a few specimens of *Uvularia puberula* var. *nitida* (new, discovered by Terry Schmidt), *Xerophyllum asphodeloides, Morella caroliniensis, Arethusa bulbosa, Platanthera blephariglottis, Osmunda cinnamomea* (=*Osmundastrum cinnamomeum*), *Galium* sp., *Dichanthelium dichotomum* var. *lucidum, D. scabriusculum, Panicum virgatum, Trientalis borealis, Rubus hispidus, Mitchella repens, Smilax glauca, Sphagnum bartlettianum*, and *S. magellanicum*. Thanks to Terry Schmidt for maintaining a species list.

Attendance: 18. **Report by leader: Ted Gordon.**

06 July (Saturday): Dutchtown, Atsion, Old Forge Pond above Pleasant Mills, Wharton State Forest, Burlington and Atlantic Counties, New Jersey.

Plans to explore bog asphodel savannahs of Nescochague Creek watershed had to be abandoned because of severe flooding of West Mills Road which prevented passage for all but 4-wheel drive vehicles with monster tires. Botanizing took place at an alternate site on the edge of former bog-ore excavations at the Miller cranberry bogs just south of Dutchtown west of Route 206. Here we devoted most of the morning to compiling an extensive species list.

Plants observed at Miller's Bogs

Acer rubrum var. *trilobum, Sagittaria engelmanniana, Rhus copallinum, Apocynum androsaemifolium, Ilex glabra, Bidens* sp., *Centaurea biebersteinii* (=*C. stoebe* subsp. *micranthos*), *Chrysopsis mariana, Eupatorium pilosum, Heterotheca subaxillaris, Hypochaeris radicata, Pluchea camphorata, Symphyotrichum novi-belgii, Betula populifolia, Woodwardia virginica, Lobelia nuttallii, Hudsonia ericoides, Lechea racemulosa, Clethra alnifolia, Hypericum canadense, H. gentianoides, Triadenum virginicum, Chamaecyparis thyoides, Carex striata, Cladium mariscoides, Cyperus dentatus, C. grayi, Eleocharis microcarpa, E. tenuis, E. tuberculosa, Rhynchospora alba, R. chalarocephala, Drosera filiformis, D. intermedia, Chamaedaphne calyculata, Eubotrys racemosa, Gaylussacia dumosa, Kalmia latifolia, Leiophyllum buxifolium, Lyonia ligustrina, L. mariana, Vaccinium corymbosum, V. macrocarpon, Lachnanthes caroliana, Sisyrinchium atlanticum, Juncus acuminatus, J. biflorus, J. canadensis, J. debilis, J. effusus, J. marginatus, J. scirpoides, Utricularia striata, Lycopodiella appressa, Decodon verticillatus, Morella caroliniensis, Nuphar lutea* ssp. *variegata* (= *N. variegata*), *Nymphaea odorata, Pinus rigida, Plantago aristata, Agrostis hyemalis, A. perennans, Amphicarpum amphicarpon* (= *A. purshii*), *Andropogon glomeratus, A. virginicus, Calamovilfa brevipilis, Dichanthelium dichotomum* var. *ensifolium, Muhlenbergia torreyana, Panicum verrucosum, P. virgatum, Paspalum* sp., *Polygala lutea, P. nuttallii, Pontederia cordata, Rubus hispidus, Cephalanthus occidentalis, Diodia teres, Verbascum thapsus, Smilax glauca, Viola lanceolata* var. *lanceolata, Xyris difformis*, and *X. torta.*

We next made a brief stop along the Mullica River corridor east of Atsion to see a fine display of pine barren death–camus, *Zigadenus leimanthoides* (= *Stenanthium leimanthoides*). Growing in exposed sand of the adjacent pitch pine forest were *Hudsonia ericoides, H. tomentosa, Euphorbia ipecacuanhae*, and *Minuartia caroliniana* (= *Arenaria caroliniana*).

We travelled to Pleasant Mills and parked at the historic 1808 church and cemetery along Route 542. The old West Mill Road was blocked to vehicular traffic, and we had to hike ca. ¾ mile to the Bridge 5 segment of "old Batsto Nature Trail" (developed by the Pine Barren Conservationists back in the late 1950s and long ago abandoned). Visited by many busloads of visitors especially during the summer and fall of the 1960s and early 1970s, this trail was generally reputed to be one of the finest nature paths ever devised in the Pine Barrens. The lack of state supervision of the site led to acts of vandalism that, in part, led to its demise. On our visit, it was clear that beaver activities over many years had dramatically altered the bog landscape along the meandering Meschescatauxin Creek, a small feeder of the Mullica. Many boggy pockets that once were botanically significant had become permanently flooded and lost their rarities. Recent high water level related to rainfall limited our botanizing.

Plants at Old Batsto Nature Trail (Bridge #5 & vicinity) near Pleasant Mills

Ilex glabra, Oclemena nemoralis, Brasenia schreberi, Saponaria officinalis, Clethra alnifolia, Cuscuta gronovii, Chamaecyparis thyoides, Carex pensylvanica, Cladium mariscoides, Dulichium arundinaceum, Eleocharis tuberculosa, Rhynchospora chalarocephala, R. fusca, Schoenoplectus subterminalis, Pteridium aquilinum, Pyxidanthera barbulata, Drosera filiformis, D. intermedia, D. rotundifolia, Chamaedaphne calyculata, Gaultheria procumbens, Vaccinium corymbosum, V. macrocarpon, Eriocaulon compressum, E. decangulare, Bartonia virginica, Sabatia difformis, Lachnanthes caroliniana, Juncus canadensis, J. militaris, Utricularia geminiscapa, U. purpurea, U. striata, Lophiola aurea, Lycopodiella alopecuroides, Pseudolycopodiella caroliniana, Pogonia ophioglossoides, Pinus rigida, Andropogon virginicus, Dichanthelium scabriusculum, Microstegium vimineum, Sarracenia purpurea, Schizaea pusilla, Sphagnum pulchrum, and *Xyris smalliana.*

We next visited the cedar-ringed Forge Pond (the former water supply for Batsto Forge), once a popular botanical destination whose bottom was carpeted by a variety of sphagnum species, three typical club mosses, sundews, pipeworts, pyxie, orchids, and curly grass fern. These were still present but one of the "pond's" specialties, a hybrid clubmoss *Lycopodiella* × *copelandii* (=*L. alopecuroides* × *L. appressa*), had eluded us. It was also noted that Atlantic white cedar had substantially expanded into the open bog mat, and shading likely has become an issue for some of the sun-loving herbs.

The afternoon temperature had swelled to 96 and dispelled all thoughts of adding a 3 mile round-trip hike to explore the Nescochague savannahs. We concluded our trip at Atsion by late afternoon.

Thanks to Terry Schmidt for maintaining a species list.

Attendance: 11. **Report by leader: Ted Gordon.**

07 July (Sunday): Hand Printing Nature Workshop at Pennypack Preserve, Huntingdon Valley, Pennsylvania. Joint workshop with the Delaware Valley Fern and Wildflower Society.

A substantial group of field botanists was introduced to the ancient technique of Nature Printing at beautiful Pennypack Preserve. After two and a half hours of collecting and printing abundant specimens from the wandering trails of Pennypack, and utilizing sprigs of sage, lavender, grapevine, ivy, black-eyed susan and other plants brought from the instructor's garden, many lovely nature prints were accomplished.

Nature printing is the ancient art, craft and science of obtaining direct prints from organic objects. Ink is carefully applied to a fresh specimen, which is then pressed to paper revealing its form and distinctive, textured characteristics, such as veining. Depending on the type of ink, paper and amount of pressure used, even very delicate flowers, and parts such as roots, stamens and hairs, can be nature printed.

The instructor believes reverence and sensitivity to be particularly important criteria for creating well-defined, skillful nature prints of plants. Even a modest understanding and appreciation for the qualities of plants – their unique forms, pattens and structures – contribute to making authentic, successful impressions of them.

Those who study, work or play with plant life have an innate proficiency and resourcefulness for plant printing. With frequent handling of plants, they acquire dexterity (hands are full of insight!), and as they begin printing, the creativity within bubbles out

easily, competently. Those who have never worked with inks need a little extra practice, but after becoming familiar with the materials, their love of all things botanical takes over. Registrants: 19. **Report by instructor: Laura Bethmann.**

20 July (Saturday); Rescheduled to 17 August: Crow's Nest Preserve, Chester and Berks Counties, Pennsylvania.
Leader: Paul Schubert. Trip canceled.

21 July (Sunday): Hazelton Bog (Valmont Bog Sanctuary), Luzerne County, Pennsylvanica. Joint trip with the North Branch Land Trust.

The Hazleton Bog was owned for many years by an industrial park, but, because of the botanical importance of this cold bog, the property was recently acquired by the North Branch Land Trust. The highlight was fringed orchids: *Platanthera blephariglottis* and *P. ciliaris* and a swarm consisting of their hybrid (*Platanthera* × *bicolor*), including backcrosses with the parents. We saw flowers that were pure white, flowers that were the bright yellow-orange of *P. ciliaris*, and every shade in between. *Calopogon tuberosus* (grass pink) was also in bloom. *Gentiana linearis* (narrowleaf gentian) was in bud. The northern affinity of this bog was evident from species such as *Cornus canadensis* (bunchberry), *Rubus dalibarda* (= *Dalibarda repens*; dew-drop), *Trillium undulatum* (painted trillium), and *Coptis trifolia* (=*C. groenlandica*; gold-thread). The most interesting pteridophytes were a small patch of *Lycopodiella inundata* (= *Lycopodium inundatum*; northern bog clubmoss), and several very large patches of *Lygodium palmatum* (climbing fern). In drier areas we saw *Amianthium muscitoxicum* (fly poison) in fruit.

The species recorded on the trip were *Acer rubrum, Ambrosia artemisiifolia, Amelanchier* sp. (perhaps *stolonifera*), *Amianthium muscitoxicum, Aronia* sp. (*melanocarpa* or *floribunda*), *Artemisia vulgaris, Bartonia virginica, Betula populifolia, Bidens* sp., *Calamagrostis* sp., *Calopogon tuberosus, Carex folliculata, C. gynandra, C. intumescens, Centaurea stoebe, Clematis virginiana, Comptonia peregrina, Coptis trifolia, Cornus canadensis, Coronilla varia, Daucus carota, Dendrolycopodium obscurum, Dennstaedtia punctilobula, Digitaria* sp., *Diphasiastrum digitatum, Drosera rotundifolia, Dulichium arundinaceum, Eleocharis tenuis* var. *tenuis, Erechtites hieraciifolius, Eriophorum virginicum, Euthamia graminifolia, Galium mollugo, Gaultheria procumbens, Gaylussacia baccata, Gentiana linearis, Glyceria grandis, Hypericum canadense, H. gentianoides, H. perforatum, H. punctatum, Hypoxis hirsuta, Ilex mucronata, I. verticillata, Iris versicolor, Juncus marginatus, Kalmia angustifolia, K. latifolia, Leucanthemum vulgare, Lobelia inflata, Lotus corniculatus, Lycopodiella inundata, Lycopus* sp., *Lygodium palmatum, Lysimachia quadrifolia, Maianthemum canadense, Medeola virginiana, Mitchella repens, Muhlenbergia uniflora, Onoclea sensibilis, Osmunda cinnamomea, O. claytoniana, O. regalis, Pinus rigida, P. strobus, Plantago lanceolata, P. major, Platanthera blephariglottis, P. ciliaris, Platanthera* × *bicolor, Polygonum sagittatum, Populus tremuloides, Pteridium aquilinum, Pyrus calleryana, Quercus alba, Q. ilicifolia, Q. rubra, Rhododendron maximum, Rhynchospora* sp., *Rubus dalibarda, R.* sp., *Rumex acetosella, Sambucus canadensis, Scirpus cyperinus, Smilax glauca, Solidago juncea, S. odora, S. puberula, S. rugosa, Spiraea alba, S. tomentosa, Symplocarpus foetidus, Trientalis borealis, Trifolium campestre, T. dubium, T. pratense, T. repens, Trillium undulatum, Tsuga canadensis, Typha* sp., *Vaccinium corymbosum* s.l., *V. macrocarpon, Viburnum cassinoides, Viola sagittata*, and *Xyris difformis.*

Attendance: approximately 30. **Leaders: Janet Novak and Bob Sprague. Report by the former.**

03 August (Saturday): Fern Identification Workshop-Beyond the Basics, Cedars House, Fairmount Park, northwest Philadelphia, Pennsylvanica. Joint trip with the Delaware Valley Fern and Wildflower Society.

Indoors, at Cedars House in Fairmount Park, we discussed some of the area's ferns that can be confused with each other:

- *Pellaea atropurpurea* and *P. glabella*
- *Cystopteris bulbifera, C. tennesseensis, C. protrusa, C. tenuis,* and *Woodsia obtusa*
- *Thelypteris noveboracensis, T. palustris*, and *T. simulata*
- *Dryopteris intermedia, D. carthusiana*, and *D.* × *triploidea*

We then walked in Fairmount Park along Forbidden Drive. We examined *Woodsia obtusa, Cystopteris tennesseensis*, and *Pellaea atropurpurea*, all of which are abundant on bridges over Wissahickon Creek and on other old stonework in the park. This stonework, mostly from the 1930s, is obviously favorable habitat for epipetric ferns. The abundance of *C. tennesseensis* is particularly striking, as this fern is endangered in Pennsylvania. We also noted a few plants of *C. tennesseensis* on a natural rock outcropping. We saw a small population of another Pennsylvania-endangered fern, *Woodwardia areolata*. This population has persisted as a small but stable population for the eight years the leader has known of it. On the day of our visit, a third of the plants had a fallen log sitting over them, but one of our participants, Max Blaustein, works for Fairmount Park and was able to get the log carefully removed two days later. Finally, we saw many plants of *Dryopteris intermedia* and one possible *Dryopteris* × *triploidea.*

Attendance: 12. **Report by leader: Janet Novak.**

9-12 August (Friday-Monday): Ferns of Vermont, Arlington and Morristown areas. Joint trip with the Delaware Valley Fern and Wildflower Society.

On Friday afternoon we climbed a trail up Mt. Aeolus in Dorset, southern Vermont, and saw two moonworts, *Botrychium ascendens* and *B. campestre* on an exposed area near an old marble quarry. Also seen were *Cystopteris bulbifera, C. tenuis, Asplenium ruta-muraria*, and *Cryptogramma stelleri.*

Saturday morning we visited Mike Rosenthal's home gardens near Arlington to see his vast collection of ferns and fern hybrids native to the northeast and to Vermont. Mike's website has a complete list of Vermont ferns (http://floraofvermont.com/list.cshtml). In the afternoon a part of our group hiked along a stream north of Harriman Reservoir to see the newly discovered species *Isoetes viridimontana* (the Green Mountain Quillwort), recognized by Rosenthal as a new entity and confirmed as a new species through DNA sequencing by Carl Taylor at the Smithsonian. We also saw *Dryopteris campyloptera, Polystichum braunii,* and *P.* × *potteri*, the sterile hybrid of *P. braunii* and *P. acrostichoides* (Christmas fern). Another part of the group, led by Sharon Rosenthal, saw the gardens and sculptor garden at Rogerland in Arlington.

On Sunday the group drove to northern Vermont and visited a cemetery and power line cut near the Connecticut River. Here we saw *Botrychium multifidum* (leathery grape fern), *Diphasiastrum digitatum* (southern ground cedar), *D. tristachyum* (blue ground cedar), the rare hybrid *D.* × *verecundum, Lycopodium clavatum* (common clubmoss), *L. lagopus* (running clubmoss), and *Lycopodiella inundata* (bog clubmoss).

On Monday we visited Cady's Falls Nursery, an excellent source for responsibly-propagated ferns and native plants.

Attendance: 19. **Leader: Michael Rosenthal. Report by: Jack Schieber and David Lauer.**

24 August (Saturday): Sadsbury Woods Preserve, Chester County, Pennsylvanica. Leader: David Lauer. No report received.

31 August (Saturday): Upper Maurice River watershed, Cumberland County, New Jersey. Joint trip with the Torrey Botanical Society.

The trip began in Vineland near the Maurice River along Sherman Avenue. Open uplands north of Sherman Avenue and adjacent to Route 55 were explored. Here the group saw a nice diversity of *Quercus* species coming into fruit, including: *Quercus alba, Q. coccinea, Q. falcata, Q. ilicifolia, Q. marilandica, Q. montana, Q. phellos, Q. prinoides, Q. stellata,* and *Q. velutina*. The group then explored a mature pitch pine (*Pinus rigida*) forest where large carpets of *Gaultheria procumbens* (fr.) and a few clumps of *Monotropa uniflora* (fl.) were observed as well as a few clumps of *Xerophyllum asphodeloides*, a rare species in Cumberland County. In a nearby mature Atlantic white cedar (*Chamaecyparis thyoides*) swamp, excellent stands of *Platanthera clavellata* (late fl., fr.) were observed, along with the federally-threatened *Helonias bullata* and the state-rare *Smilax laurifolia* (fl.). Additional specimens of Swamp pink were also observed in a cedar swamp south of Sherman Avenue. The highlight of the trip (not known until collected material was later identified) was a large population of the state-endangered *Eleocharis tortilis*, last reported for the county in 1923 by Bayard Long from this area. Several individuals of *Spiranthes* were observed in tight bud, its positive identification having to wait until another day. The group's attempt to explore the open bog where *Schizaea pusilla* and *Juncus caesariensis* were recently observed (see *Bartonia* 66: 102. 2013) was unsuccessful, access proving too difficult due to the high water table. Michael Feder focused on *Cyperus* and identified the following: *C. erythrorhizos, C. echinatus, C. flavescens, C. grayi, C. iria, C. retrorsus, C. strigosus* and *C. pseudovegetus,* the last endangered in New Jersey and previously unreported from the county. Sandy, open roadsides along Sherman Avenue in Deerfield Township were then explored and the rare *Toxicodendron pubescens* and *Trichostema setaceum* were observed in flower, the population of the latter being over 1000 plants. In this area unusual material of *Polygonatum* was observed. The material keyed to *Polygonatum biflorum* but, unlike typical *P. biflorum,* the stems were quite thick, the leaves were exceptionally succulent, and the fruits were ovoid. These characters align more with the tetraploid taxon, *P. commutatum* (= P. *biflorum* var. *commutatum, P. giganteum, P. canaliculatum* misapplied), which is sometimes held as distinct from the diploid *P. biflorum*. However, *P. commutatum* is supposed to be much larger than diploid *P. biflorum*, (the stems sometimes reaching up to 2 m; see Fernald, Gray's Manual: 442. 1950), and the material observed was not larger than *P. biflorum*. On the last stop of the day, the group saw on dry ground the state's only known population of *Polygala curtissii*, approximately two dozen plants in late flower. Other species noted in bloom were *Eurybia compacta* (= *Aster gracilis*) and *Polygala nuttallii.*
Attendance: 18. **Report by leaders: Uli Lorimer and Gerry Moore.**

08 September (Sunday): Thomas F. Breden Preserve, Milford Bluffs, Hunterton County, New Jersey. Joint trip with the Delaware Fern and Wildflower Society. Leader: Doug Kligman. No report received.

14 September (Saturday): Lower Manantico, Manumuskin, and Maurice River watersheds, Cumberland County, New Jersey. Joint trip with the Torrey Botanical Society.

The group first explored the ponds associated with the Manantico Creek in Millville above and below the Pennsylvania Railroad. The leader pointed out that these ponds are the result of past sand and gravel mining activities. Unlike most other mining in the area some of the mining here was done directly in the creek bed. The leader read from a 1931 report written by Hugh Haddow Jr., vice-president and general manager of the former Menantico Sand & Gravel Company, prepared for the U.S. Bureau of Mines (Information Circular 6420) that explained this pattern. The earlier mining activities focused on gravel deposits (to be used in road construction) that were located in and near the creek bed. The leader also pointed out that the ponds above the railroad today are tidal but previously (1970s) these ponds were not tidal. The marshes here support typical freshwater tidal marsh vegetation, and species noted included: *Acorus calamus, Asclepias incarnata, Bidens laevis, Boehmeria cylindrica, Chelone glabra, Echinochloa walteri, Elodea nuttallii, Hibiscus moscheutos, Hypericum densiflorum, Leersia oryzoides, Lobelia cardinalis, Peltandra virginica, Polygonum arifolium, P. hydropiperoides, P. punctatum, P. sagittatum, Pontederia cordata, Sparganium americanum, Spiraea tomentosa, Thalictrum pubescens, Typha glauca, Vernonia noveboracensis*, and *Zizania aquatica*. Good stands of the rare *Eriocaulon parkeri* and *Elatine americana* were noted, as was a small patch of the non-native *Kyllinga gracillima* (= *Cyperus brevifolioides*). The group then traveled east to Manumuskin Station in Maurice River Township. In the sandy uplands along the railroad, the adventives *Ipomopsis rubra* and *Strophostyles leiosperma* and the rare *Desmodium strictum* were all observed in bloom. In the freshwater tidal marshes adjacent to the Manumuskin River, many of the same species noted at Manantico were observed, although the populations of *Zizania aquatica* were much more extensive along the Manumuskin. Above the railroad, the group was pleased to observe individuals in flower and fruit of the federally-threatened *Aeschynomene virginica*. Below the railroad, along the edge of the tidal marsh, a population of *Spiranthes cernua* in flower was observed. The last stop was back in central Millville where the group explored the freshwater tidal marshes and mud flats along the Maurice River below the Union Lake Dam. Here the group saw most of the species observed during a 2010 trip to the area (see *Bartonia* 66: 99-102. 2013). One pleasant addition was a few stands of the rare *Bidens bidentoides* along the edges of the marshes and mudflats closer to the tree line. Some individuals were growing out of old tree stumps. Less pleasant was documenting the extensive spread (since the 2010 trip) of the non-native invasive *Murdannia keisak*.
Attendance: 14. **Report by leaders: Uli Lorimer and Gerry Moore.**

15 September (Sunday): Plant families in the field, Delhaas Woods, Bucks County, Pennsylvania.

The group met at the Silver Lake Nature Center along Bath Road in Bristol. The trip focused primarily on the new plant family concepts published by the Angiosperm Phylogeny Group. Using examples found in the coastal-plain site of Delhaas Woods, we discussed the morphological characteristics of the various new families that have been reclassified as a result of molecular phylogenetic studies. Among the examples of new family definitions were those including the following genera present at this site: *Viburnum dentatum, V. nudum* (Adoxaceae); *Liquidambar styraciflua* (Altingiaceae); *Agalinis purpurea* (Orobanchaceae);

Paulownia tomentosa (Paulowniaceae); *Gratiola aurea, Linaria canadensis, Penstemon digitalis* (Plantaginaceae); and *Ailanthus altissima* (Simaroubaceae).
Attendance: Approximately 12. **Report by leader: Alina Freire-Fierro.**

28 September (Saturday): A Bartram Tour Through the New Jersey Pine Barrens. Leaders: Joel Frey and Bill Cahill. No report received.

04-06 (Friday-Sunday) October: John Burroughs' Slabsides and the Esopus Gorge, West Park, New York. Joint trip with the Delaware Valley Fern and Wildflower Society. Leader: David Lauer. Trip canceled.

12 (Saturday) & 13 (Sunday) October: Delaware Bayshore, Cumberland County, New Jersey. Joint trip with the Torrey Botanical Society.

The focus of this trip was to visit areas along the Delaware Bayshore some of which are threatened by sea level rise and land subsidence. The group met in the historic town of Greenwich along Ye Great Street and then traveled to Bayside, previously known as Caviar, due to the short-lived sturgeon fishery there in the late 1800s. At its height of activity, 15 train cars of sturgeon products were shipped daily from Caviar. Today, the species responsible for this industry, the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), is a federally-endangered species. After the collapse of the fishing industry, the village's only claim to fame was that it was home to Hall-of-Fame major league baseball player (1921–1938) Goose Gosslin (1900–1971).

Many of the common species associated with salt marshes and their associated environs were observed, including *Amaranthus* (*Acnida*) *cannabinus, Atriplex hastata, Baccharis halimifolia, Cyperus filicinus, Distichlis spicata, Iva frutescens, Juncus gerardi, Polygonum ramosissimum, Spartina alterniflora, S. cynosuroides,* and *S. patens*. In open muddy areas *Lilaeopsis chinensis* was observed. This species was considered "very rare" by Witmer Stone in his *Plants of Southern New Jersey* (p. 598). Stone's discovery of a population of it, purported to be a re-discovery of Thomas Nuttall's (ca. 1817) Egg Harbour station, was published in *Bartonia* 1: 20-24. 1908. (See Eisenman in *Bartonia* 66: 61-70. 2013 for a discussion of early usage of the place name "Egg Harbour.") The group then visited the Tindall Island area near the confluence of the Cohansey River with the Delaware Bay. Here in the salt marshes, the group compared the two salt marsh asters, the annual *Symphyotrichum subulatum* (=*Aster subulatus*) and the perennial *Symphyotrichum tenuifolium* (=*Aster tenuifolius*). The group then traveled to Sea Breeze in Fairfield Township, a town that today is nearly abandoned. Back in the late 1800s and early 1900s it was a noted summer resort with two hotels and a daily ferry running to it from Philadelphia. The group walked Sea Breeze's only road, unpaved Beach Avenue, and then ate lunch under a grove of *Populus alba* trees. A large patch of dried grass caught the group's eye. It was later identified as *Bouteloua curtipendula*, an endangered species in New Jersey, although the material at Sea Breeze is perhaps not native. Dune grass *Ammophila breviligulata* was also noted here in the few dunes that remain in the area. The last stop of the day was Bay Point in Lawrence Township, where along the edge of the salt marshes blooming individuals of *Helianthus giganteus* were noted, some of the individuals approaching 3 m in height.

On the second day the tidal wetlands of Turkey Point in Downe Township were visited. Here adjacent to the salt marshes, a few native individuals of *Pinus taeda*, rare in New Jersey, were observed. The next stop was the Hansey Creek area in Commercial Township. Here

in the woodlands adjacent to the tidal marshes, the state-endangered *Quercus nigra* was noted, some with fruit. In open moist areas adjacent to the tidal marsh, *Agalinis purpurea* was noted in bloom, and in the tidal wetlands *Agalinis maritima, Spergularia marina,* and *Limonium carolinianum* were noted in bloom. West of Port Norris, disturbed open sandy, tidal wetlands and uplands areas associated with past salt hay farming were explored. Good stands of the rare *Leptochloa fascicularis* var. *maritima* and *Panicum dichotomiflorum* were observed, as well as many chenopods, including: *Bassia hirsuta, Chenopodium album, C. ambrosioides, C. pratericola* (rare in New Jersey), *Cycloloma atriplicifolium, Kochia scoparia, Salicornia europaea*, and *Salsola kali.* At Bivalve the group saw a large population of the rare *Sesuvium maritimum* and a small population of the rare *Setaria magna. Bassia hyssopifolia* was also observed here. The last stop was the Thompsons Beach area in Maurice River Township, where the group saw another population of the rare *Sesuvium maritimum*, as well as a few individuals of the rare *Suaeda calceoliformis*. Some of the participants returned to Port Norris for dinner at a bayside restaurant in Shell Pile.
Attendance: 12 (12 Oct), 14 (13 Oct.). **Report by leader: Gerry Moore.**

17 November (Sunday): Tour of the Chrysler Herbarium, Rutgers University, New Brunswick, New Jersey.

Intended to begin at 1:00 PM, this meeting was inadvertently mis-advertised for 10:00 AM, without the knowledge of the leader. Tired of waiting, several potential participants left shortly before noon, prior to the arrival of the leader. The single remaining member had a nice tour of the hebarium.
Attendance: 1. **Leader: Lauren Spitz**

23 November (Saturday): Bear Swamp, Downe Township, Cumberland County, New Jersey. Joint trip with the Torrey Botanical Society.

On this cool fall morning, a large group of botanists and lichenologists arrived at rural Frames Corner in Downe Township. This large assembly surprised area residents, who came out to greet the group and learn of the botanical treasure in their backyard. Bear Swamp is an impressive mature hardwood forest that includes areas of old growth. The Natural Lands Trust (NLT) manages the tract and representatives Steve Eisenhauer and Brian Johnson provided overviews of the property. Ken Taaffe, a retired USDA forester who is working with NLT in developing a forestry plan, was also present.

The group headed west along the railroad from Payntors Corner and then hiked south through the woods toward some of the stands of old growth. Two rare trees were encountered, *Pinus serotina* and *Quercus michauxii*, both species reaching the northern limit of their ranges on the Coastal Plain of southern New Jersey. Closer to the old growth area, a fine population of *Phoradendron leucarpum* was observed growing on *Nyssa sylvatica* adjacent to one of the borrow pits adjacent to the swamp. In an old growth area of *Acer rubrum, Ilex opaca, Liquidambar styraciflua*, and *Nyssa sylvatica,* several large specimens of *Magnolia virginiana* were observed. The largest magnolia was 63 inches in circumference, 10.5 inches smaller than the windthrown record tree discovered in 1986 on a Philadelphia Botanical Club trip (Bartonia 53: 68–69. 1987). An insect of note on Ilex, on this day so late in the year, was the large leafhopper *Oncometopia orbona*. *O. orbona* is the only widespread species of this genus, reaching the northern limit of its range in New Jersey and Pennsylvania. This species feeds on herbs in open areas during the summer but returns to forests in the fall to feed on woody plants. A couple of populations of *Tipularia discolor*

were observed, and gave the group an opportunity to observe the "reverse" adaptations this species has with respect to leaf development. First, the leaves emerge in the fall and whither in the spring. Furthermore, as was observed on the trip, the leaves are a dark purple when they first emerge and then turn green on the adaxial surface, the abaxial surface remaining purple. From a light perspective, it is advantageous to have the leaves present in the winter since much more light reaches the forest floor during this season. As the group began to walk out of the old growth area, a small stand of *Chamaecyparis thyoides* was observed. Stands of white cedar are rare in Bear Swamp and none of them is old growth.

Southern New Jersey, Bear Swamp in particular, has been recognized for hosting the northernmost populations of many subtropical lichen species that are much more common further south along the Atlantic Coast. We reexamined populations of the tropical script lichen *Fissurina insidiosa* C. Knight & Mitten, that coated the larger individuals of *Magnolia virginiana* in place. We also added three new lichen records for the state, all southern species that appear to reach the northern limit of their distribution in Bear Swamp. First among these was the tiny crustose species *Ramonia microspora* Vězda (Lendemer 30480, 30482, 30484; NY), which forms white apothecia that erupt out of the bark of hardwood trees. Second was *Opegrapha viridis* (Ach.) Behlen & Desberger (Lendemer 30477, NY) which is among the most recognizable species of *Opegrapha* due to its many-celled spores and short unbranching black lirellae. The most remarkable discovery was that of *Canoparmelia caroliniana* (Nyl.) Elix & Hale (Hodkinson 18035, NY) which is one of the most common foliose lichens in southeastern North America. The species resembles *Punctelia rudecta* (Ach.) Krog, which is ubiquitous in New Jersey, but lacks the white pseudocyphellae on the upper surface, has a black lower surface, and produces a different chemical substance in the thallus. We have searched for *C. caroliniana* throughout New Jersey for more than a decade, assuming that it must be present because it is common just south on the Delmarva Peninsula. The discovery of this, and other species, serves as an important baseline against which the response of species to a changing climate can be measured.

In addition to the unusual southern species found in Bear Swamp, the group observed a number of common local species including the macrolichens *Flavoparmelia caperata* (L.) Hale, *Parmotrema hypotropum* (Nyl.) Hale, and *Punctelia caseana* Lendemer & B.P. Hodk. Many crustose lichens were also seen, including *Buellia curtisii* (Tuck.) Imsh., *Lecanora hybocarpa* (Tuck.) Brodo, and *Pyrrhospora varians* (Ach.) R.C. Harris. A large population of *Cladonia atlantica* A. Evans was also observed, which is one of the few lichen species whose core range comprises southern New Jersey. While most lichen species that occur in southern New Jersey are common elsewhere in North America, this small group of species is common there and rare elsewhere in their ranges.
Attendance: 28. **Report by leaders: James Lendemer and Gerry Moore.**

08 December (Sunday): Winter Botany, Spring Mountain and the Perkiomen Trail, Montgomy County, Pennsylvania.

Spring Mountain, a short distance north of Chancellorsville, is a small peak composed of diabase, a volcanic rock that gives rise to a rich soil and, often, a rich flora. Our walk started at the weedy edge of the parking lot off Cedar Road, but we soon reached the Perkiomen Trail as it passed by a rather nice small meadow. Plants in the meadow included *Sabatia angularis, Pycnanthemum tenuifolium*, and quite a bit of *Penstemon digitalis*. In a roadside ditch we saw a plant of distinctive winter appearance that is not in the common winter field guides. This plant is *Cuphea viscosissima*, in which the fruit is surrounded by

a swollen, hairy calyx tube. By winter, the calyx tube has split but remains attached to the stem, and the remnants make a good identifying feature. We continued to follow the trail as it arched around Spring Mountain. The habitat here was rocky woods that sloped down to Perkiomen Creek. Some of the trees were of impressive size. We saw species typical of woods on diabase: *Quercus montana, Hamamelis virginiana, Ostrya virginiana,* and *Staphylea trifolia*. Herbaceous plants that were recognizable included *Cimicifuga racemosa, Phryma leptostachya, Conopholis americana, Dryopteris marginalis*, and *D. intermedia. Acer spicatum* has been reported on the north side of Spring Mountain, and we found a small maple that we strongly suspect to be *Acer spicatum*. We vowed to return during the growing season to confirm it.

Attendance: 7. **Report by leader: Janet Novak.**

Program of Meetings
September 2013–June 2014

Date	*Subject*	*Speaker*
2013		
26 Sept	Members' Reports on Summer Botanizing	
24 Oct	A Brief Introduction to the Freshwater Green Algae of New Jersey and Pennsylvania	John Hall
21 Nov	Life in the Concrete Jungle: Patterns and Drivers of Biodiversity in the World's Cities	Myla Aronson
19 Dec	Ragweed and Civilization	Ken Frank
2014		
23 Jan	Plants and their History in and around the German Township	Nicole Juday
27 Feb	Chile Peppers: Heat and History	Joseph Rucker
27 Mar	The Natural History of Spring Wildflowers: A Closer Look	Carol Gracie
24 Apr	The Schuyler Lecture in North American Botany and Botanists: Native Americans, Smokey Bear and the Rise and Fall of Eastern Oak Forests	Marc Abrams
22 May	Plant Hunting in China	Ron Rabideau
26 Jun	Members' Reports on Spring Botanizing	

BARTONIA

Instructions to Authors

Types of Articles Published

Research papers communicate original research in plant ecology, plant conservation biology, plant systematics, and related topics. Other contributed papers convey the results of studies in floristics, distribution, methods, biography, bibliography, history of botanical exploration, and other topics of botanical interest. Short reports of one or two pages appear in "News and Notes." Other items include obituaries, book reviews, and field trip reports. The focus is on the mid-Atlantic region (Pennsylvania, New Jersey, Delaware, Maryland, New York, Virginia, and West Virginia), but contributions of interest to Bartonia readers from farther afield are welcomed.

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Write in simple, clear sentences. Use the active voice where possible. Avoid redundancy. *Bartonia* generally conforms to the Council of Biology Editors, Committee on Form and Style, *CBE Style Manual.*

Consult recent issues of *Bartonia* for style of main headings, subheadings, literature references, table and figure captions, and tables.

Double-space *all text*, including tables.

Do not justify the right margin.

Arrange manuscript copy in this order:

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  - Abstract
  - Introduction
  - Methods
  - Results
  - Discussion (may include Conclusions)
  - Literature Cited
  - Acknowledgments
  - Tables (with captions)
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- Figures: send each figure as a separate file using the any of the below formats (note the resolution requirements)
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Submission of a manuscript implies that it is not under consideration in a similar form elsewhere. Authors should electronically send the manuscript with all tables and figures to the Editor. Manuscripts with multiple authors should be accompanied by a clear designation of the corresponding author, to whom all communication from the Editor should be addressed.

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